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**Electrical Review.**

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# WILL ATLANTIC TRAFFIC SUPPORT TWO NEW CABLES?

THIS is a question which has frequently been presented in the public press; and, in their anxiety to prove that two new cables can be supported, the promoters of these schemes have very often drawn on their imagination for so-called facts.

As the subject is of some interest, we, as a telegraphic journal, think fit, with the view of laying definitely before our readers the exact state of trans-atlantic telegraph traffic, to investigate it, and to discuss whether two new Atlantic cables would really pay.

There are at present working between Europe and America, *eight* submarine cables, of which four belong to the Anglo-American Telegraph Company, laid respectively in 1869, 1873, 1874 and 1880; two, leased by the Western Union Telegraph Company of America, submerged respectively in 1881 and 1882; the Direct United States Company owns one cable, put down early in 1875; and the Cie Paris à New York, commonly called the Pouyer-Quertier, also owns a cable, laid in 1879.

In his address to the shareholders of the Direct United States Telegraph Company, published in our City Notes, on the 17th February of this year, the chairman, Mr. Pender, said, that the value of the shares in the market shows that the Direct United States cable is considered to be worth £800,000. He also observed that the two cables leased by the Western Union Telegraph Company, cost the American Telegraph and Cable Company £1,400,000. It would appear that the Western Union considered this sum too small, as representing the value of the property, as, according to Mr. Pender, they leased these two lines, guaranteeing to the American Telegraph and Cable Company 5 per cent. per annum on a capital of £2,800,000.

Let us take the current prices of cable stocks and calculate the value represented by each cable:—

*Anglo-American Company.*

| | | | Paid. | Quotation. | Value. |
|---|---|---|---|---|---|
| | | | | | £ |
| £2,116,400 | Stk. | Anglo-American, Limited | 100 | 48 | 1,015,872 |
| £2,441,800 | Stk. | Do. Preferred (Deferred receiving no dividend until 6 per cent. has been paid to Preference.) | 100 | 80 | 1,953,440 |
| £2,441,800 | Stk. | Do. Deferred (Deferred receiving no dividend until 6 per cent. has been paid to Preference.) | 100 | 17½ | 427,315 |
| For four cables, therefore, the value is ... | | | | | £3,396,627 |
| Or say, for each cable ... ... ... ... | | | | | £849,157 |

*American Telegraph and Cable Company.*

| | | | Paid. | Quotation. | Value. |
|---|---|---|---|---|---|
| | | | | | £ |
| £2,800,000 | Stk. | Under 5 per cent. guarantee from Western Union for 50 years . | 100 | 62½ | 1,737,400 |
| For two cables, therefore, the value is ... | | | | | £1,737,400 |
| Or say, for each cable ... ... ... ... | | | | | £868,700 |

*Direct United States Telegraph Company.*

| | | | Paid. | Quotation. | Value. |
|---|---|---|---|---|---|
| | | | | | £ |
| £65,000 | 20 | D.U.S. Cable, Limited; company reconstructed in 1877 . | 20 | 13 | 845,000 |
| £100,000 | 100 | Do., 6 per cent. debenture, repayable 1884 | 100 | 100 | 100,000 |
| For one cable the value is ... ... ... | | | | | £945,000 |

*Pouyer-Quertier Company.*

| Francs. | Frs. | | | | Frs. |
|---|---|---|---|---|---|
| 42,000,000 | 500 | Ordinary stock . | 500 | 245 | 20,580,000 |
| Value for one cable is therefore ... ... | | | | | £823,200 |

From the foregoing it will be seen that the figures given by Mr. Pender, viz., £800,000 per cable, are, if anything, under the real amounts, which may be taken at £850,000 per cable.

The Direct United States cable shows a considerably higher value; but if it is taken into account that this cable receives 16·275 per cent. of the total traffic, as against an average of 11·612 per cent. to each of the other cables, the increased market value can be easily understood.

To resume, an Atlantic cable at present quotations appears worth £850,000. Messrs. Siemens Bros. laid two Atlantics for Mr. Jay Gould, as above stated, for £700,000 each, and the probability is, that if the three contractors, the Telegraph Construction and Maintenance Company, the India Rubber, Gutta Percha and Telegraph Works Company, and Messrs. Siemens Bros., were placed in competition, the sum for which Atlantic cables could be laid would be considerably under £700,000 each.

Let us here consider the traffic through the existing trans-atlantic lines with a two shilling rate, and we find that for the six months ending 30th June last, the gross receipts were at the rate of £866,730 per annum, and, deducting £222,093 as expenses, we have a net traffic of £644,637.

Taking, again, the figures given by the chairman of the Anglo-American Company, we find, that during the six months beginning August, 1882, and ending January, 1883, the gross traffic amounted to £510,490, or say, at the rate of £1,020,980 per annum.

From these two statements, it would appear that the traffic fluctuates between £867,000 and £1,020,000 per annum. As the first is calculated on the first half of the year and the second on the last half of the year, it would be fair to take the mean, say £943,500 as the average yearly gross return.

In taking this figure to get the net return, we should deduct £222,100, the annual expenses above given, and we have net receipts of £721,400.

To refer again to the price of cables: by laying two new Atlantics, the number of cables would then rise to 10, and, estimating the cost of making and laying two new cables at the figures (£700,000 each) for which Messrs. Siemens Bros. laid the two Jay Gould cables, we have £1,400,000 as cost of cables, representing $\frac{2}{10}$ths of the carrying capacity of the Atlantic lines. It may, therefore, be presumed that the traffic for the new lines would be $\frac{2}{10}$ths of the total traffic; but we have said

that the total net traffic at the two shilling rate amounts to £721,400, and therefore $\frac{2}{10}$ths of this would represent the new cables' proportion of traffic and would be, say £144,280.

Is an income of £144,280 sufficient for a capital of £1,400,000?

From market prices, it seems that the public expect, for cable property, about 7½ per cent. interest on their capital. This would consume £105,000 of the net receipts, and leave only £39,000 to carry forward annually to reserve fund. We think, therefore, that the present traffic would do no more than support two new cables, if the price of these cables is as given above.

Taking, however, £1,200,000, a sum to which competition would be certain to bring contractors, as the cost of two cables, it would be possible to pay the 7½ per cent. the shareholders expect for their money, and to carry forward about 5 per cent. annually to the reserve fund.

These calculations are based on existing figures and make no allowance for the certainly-increasing traffic by telegraph. We leave speculations of this kind to some of our more flighty contemporaries, who indulge in imaginary increases in gross receipts due to reduction of rates.

There is no doubt that, should two new cables be laid, a cutting of rates will ensue; but a new undertaking, unsaddled with watered capital, is in a better position to fight than any of the existing lines, and when the inevitable working arrangement is completed, then the former would in all probability have more than the $\frac{2}{10}$ths of the traffic above referred to.

To make our statement complete, we may quote the results of the one shilling rate, as given by the Hon. Robert Grimston, who presided at the Anglo-American Company's meeting of February 9th last. He said that during the six months' beginning August, 1881, and ending January, 1882, the receipts had been £303,820, or say, at the rate of £607,640 per annum. This amount, it will be noticed, is about $\frac{3}{5}$rds of that given by the two shilling rate. The two new cables would therefore, during a shilling rate, receive about 5 per cent. for their money, and leave 3 per cent. to carry to reserve fund, &c. During this time, the other companies would be paying only one-half of this rate to the shareholders.

To finish, and to furnish the answer to our question, we believe that two new Atlantic cables can be supported by the present trans-atlantic traffic.

NOTE.—The trans-atlantic traffic is at present divided in the following proportions :—

| | |
|---|---|
| Anglo-American Company, 4 cables ... ... | 48·825 |
| Per cable ... ... ... ... ... | 12·206 |
| American Telegraph Cable Company, 2 cables | 22·5 |
| Per cable ... ... ... ... ... | 11·25 |
| Direct United States Company, 1 cable ... | 16·275 |
| Pouyer-Quertier Company, 1 cable ... ... | 12·4 |

**The Bombay Electric Light Company.**—The whole of the capital, twelve lacs, of the Bombay Electric Light Company has been subscribed.

## ELECTRO-MOTORS AND THEIR GOVERNMENT.

By Professors W. E. AYRTON, F.R.S., and JOHN PERRY, M.E.

(*Continued from p.* 196.)

The first thing we proceed to find is the dependence of torque on current. It is usually assumed that for a given current the torque is independent of the speed; but in making such an assumption the error is made of neglecting magnetic friction, and of assuming that the attraction between the field-magnet and armature is constant for a given current passing round them, the effect of the rotation, in first shifting the position of the poles, and, secondly, in weakening the strength of the resultant magnetic field due to the field-magnet and armature, being neglected. We, on the other hand, have invariably found that as the speed increases it requires a greater and greater current to produce a given torque.

The following gives a set of results obtained when using a motor weighing 30·8 lbs., consisting of a Gramme armature turning between a Siemens' field-magnet, the load on the dynamometer, or difference of weights, being kept quite constant at 0·88 lbs., and which corresponded with a useful power developed of 0·1 horse-power, at about 3,400 revolutions per minute :—

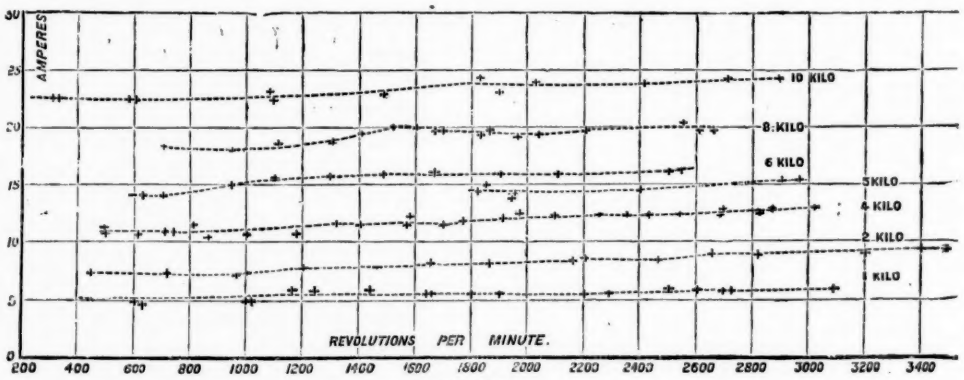



FIG. 30.

| Number of revolutions per minute. | Current in ampères. |
|---|---|
| 932 | 5·4 |
| 1,543 | 6·3 |
| 2,527 | 6·7 |
| 3,134 | 7·3 |
| 3,252 | 7·7 |
| 4,117 | 8·7 |

Fig. 30 shows the curves connecting currents, with speeds for various constant torques in the De Meritens motor. The increase of current with speed is not nearly so great as in the case of the previous motor, but it is quite observable, and the curves are very interesting, as they enable us to calculate for the particular motor the current necessary to produce any particular torque at any speed. Thus, taking these measurements for speeds of 200 and of 3,000 revolutions per minute, we obtain the two sets of points shown in fig. 31, evidently lying in the curves, A, B and C, D. If $T_{200}$ is the torque produced by a given current, C, when the speed is 200, and $T_{3000}$ the torque produced by the same current when the speed is 3,000 revolutions per minute, we have found that $T_{200} - T_{3000}$ divided by C is nearly constant for all values of C employed, and that the difference also seems to be proportional to the difference of speeds when other speeds are taken. Hence we arrive at the conclusion that in proper units the diminution in torque for a given current is

$$\cdot 00000096\ n\ C.$$

Drawing, now, from this, the imaginary curve for no

speed, and shown in E, B, fig. 31, we find that this curve satisfies the rational law,

$$T_0 = \frac{0{\cdot}002\ C^2}{1 + 0{\cdot}08\ C},$$

$T_0$ being the torque for a speed 0. So that for any other speed, $n$, we have

$$T = \frac{0{\cdot}002\ C^2}{1 + 0{\cdot}08\ C} - 0{\cdot}00000096\ n\ C.$$

It will be observed that in these experiments the friction of the bearings of the motor and dynamometer is neglected, both being small.

Instead of using the above numbers, we shall say

$$T = C f(C) - a\ n\ C,$$

so that

$$\frac{T}{C} = f(C) - a n.$$

In fig. 32 we have plotted $f(C)$, which is the value of $\frac{T}{C}$, for $n$ equals nought. We have also plotted $\frac{T}{C}$ for a speed of 3,000 revolutions per minute, and for a speed

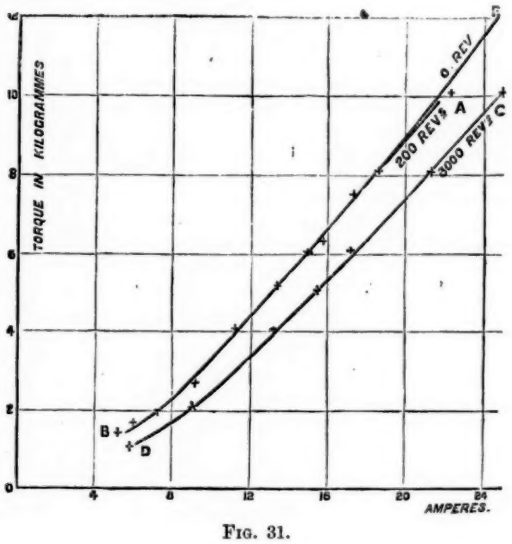



FIG. 31.

0. The efficiency of the motor is, as already stated, $\frac{T\ n}{C\ V}$ or $\frac{T}{C} \div \frac{V}{n}$. In fig. 32 there are drawn the curves for $\frac{V}{n}$, corresponding with various speeds. Now, if we imagine a set of curves drawn for $\frac{T}{C}$, for the various speeds (all of which, for speeds between 0 and 3,000 revolutions a minute, will of course be between those drawn for $\frac{T}{C}$ for $n$ equal 0, and for $n$ equal 3,000 respectively), then if two corresponding curves for $\frac{T}{C}$ and for $\frac{V}{n}$ be drawn for the same speed, the ordinate of the first curve divided by the larger ordinate of the second curve for the same current will give the efficiency of the motor for that speed and current. An examination of the curves shows that for great speeds there does not seem to be much variation in the efficiency, if we vary the speed while keeping the current constant, whereas at lower speeds the efficiency is much diminished by further diminishing the speed.

We next desire to plot a curve showing how the apparent back electromotive force, $e$, or $V - C\ R_0$, divided by $n$, varies with the current in the De Meritens machine, but we find that this function is not independent of speed, as we have found it to be in our own motor. We have therefore assumed that the law is true, and taken an average curve for all our observations. Such a curve we find satisfies the law,

$$\frac{e}{n} = f(C) + \frac{C}{6000} + \frac{0{\cdot}0147}{C}.$$

Now

$$\frac{V}{n} = \frac{e}{n} + \frac{C\ R_0}{n},$$

and we have already proved that

$$\frac{T}{C} = f(C) - a\ n,$$

therefore the efficiency

$$E = \frac{C f(C) - a\ n\ C}{C f(C) + \frac{C^2}{6000} + 0{\cdot}0147 + \frac{C^2\ R_0}{n}}$$

where

$$f(C) = \frac{0{\cdot}002\ C}{1 + 0{\cdot}08\ C}$$

and

$$a = 0{\cdot}00000096,$$

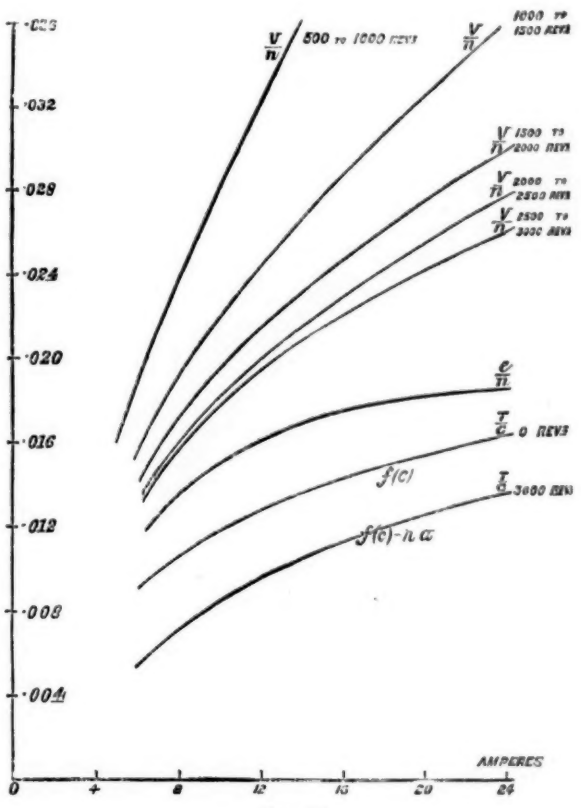



FIG. 32

and the power in watts usefully given out by this motor

$$P = n\ \{C f(C) - a\ n\ C\}.$$

Hence we can at once calculate both the efficiency of this motor and the power it will usefully develop when running at any speed and when any current is flowing through it.

For the purpose of ascertaining what efficiency and power can practically be obtained with motors of different makers, of various sizes, running at different speeds, and with different loads, we have made a considerable number of experiments from time to time.

The smallest motor we have tested is a Griscom motor, weighing 2½ lbs. A great many experiments were made, running the motor at different speeds with different loads, but the highest load or difference of weights that could be used with a dynamometer, of which the circumference was 20 centimètres, without the current dangerously heating the motor, was found

to be 0·55 lb., and a sample of the results so obtained is appended :—

GRISCOM MOTOR, 2½ LBS.

| Revolutions per minute. | Current in ampères. | Potential difference at terminals in volts. | Load on dynamometer in lbs. | Horse-power given in. | Horse-power given out. | Efficiency. |
|---|---|---|---|---|---|---|
| 633 | 6·3 | 10·6 | 0·55 | 0·0891 | 0·00693 | 0·0778 |
| 1,136 | 6·5 | 12·8 | ... | 0·112 | 0·0124 | 0·111 |
| 1,691 | 6·8 | 14·9 | ... | 0·135 | 0·0185 | 0·137 |
| 2,120 | 6·7 | 16·4 | ... | 0·147 | 0·0232 | 0·158 |
| 2,433 | 6·7 | 17·4 | ... | 0·156 | 0·0266 | 0·171 |

Resistance of this motor when warm was 1·1 ohms.

It was found, however, at the end of these experiments, that a current of 6·7 ampères was really far too much for this motor, seeing that, had we continued the experiments, the motor would have been probably damaged. We therefore ascertained what was the greatest current that could be sent for any considerable time through this motor without injuring it, and we found that a current of about 5 to 5½ ampères was the greatest. The horse-power given out by the motor in the preceding table is therefore higher than can actually be obtained in practice, and the results contained in the following set of experiments more nearly express the normal working conditions of the Griscom motor :—

GRISCOM MOTOR, 2½ LBS. (Second Set.)

| Revolutions per minute. | Current in ampères. | Potential difference at terminals in volts. | Load on dynamometer in lbs. | Horse-power given in. | Horse-power given out. | Efficiency. |
|---|---|---|---|---|---|---|
| 513 | 3·9 | 7·9 | 0·22 | ·0415 | ·00225 | ·0542 |
| 974 | 4·5 | 9·5 | ... | ·0571 | ·00427 | ·0747 |
| 1,439 | 4·6 | 10·7 | ... | ·0663 | ·00630 | ·0951 |
| 1,996 | 4·7 | 12·3 | ... | ·0774 | ·00874 | ·113 |
| 2,520 | 4·9 | 13·3 | ... | ·0874 | ·0110 | ·126 |

A useful power of about ·015 horse, with an efficiency of about 13 per cent., is the greatest that can be obtained for any length of time with the normal size Griscom motor.

The next motor in size employed was a motor with a Gramme armature and Siemens' field-magnet, weighing, with base plates, 8·03 lbs. Tests were made with loads varying from 0·55 to 1·1 lbs. on the same dynamometer, and a sample of the results with the greatest load that could be safely employed is appended :—

GRAMME ARMATURE / SIEMENS' FIELD-MAGNET } MOTOR, 8·03 LBS.

| Revolutions per minute. | Current in ampères. | Potential difference at terminals in volts. | Load on dynamometer in lbs. | Horse-power given in. | Horse-power given out. | Efficiency. |
|---|---|---|---|---|---|---|
| 803 | 16·8 | 8·9 | 1·1 | 0·201 | 0·0176 | 0·0876 |
| 1,200 | 16·8 | 10·0 | ... | 0·226 | 0·0263 | 0·147 |
| 1,953 | 17·1 | 12·0 | ... | 0·229 | 0·0428 | 0·187 |
| 2,853 | 16·9 | 13·8 | ... | 0·314 | 0·0625 | 0·199 |

Resistance of this motor when warm was 0·443 ohm.

The Jablochkoff motor, weighing 20·9 lbs., was the next tested, and the following results were obtained with the largest load that could be employed with a safe current :—

JABLOCHKOFF MOTOR, 20·9 LBS.

| Revolutions per minute. | Current in ampères. | Potential difference at terminals in volts. | Load on dynamometer in lbs. | Horse-power given in. | Horse-power given out. | Efficiency. |
|---|---|---|---|---|---|---|
| 282 | 8·9 | 20·5 | 0·88 | 0·189 | 0·00494 | 0·0261 |
| 405 | 7·0 | 22·8 | ... | 0·199 | 0·00711 | 0·0333 |
| 609 | 8·1 | 26·4 | ... | 0·286 | 0·0107 | 0·0373 |
| 680 | 8·9 | 29·2 | ... | 0·347 | 0·0119 | 0·0343 |
| 780 | 9·6 | 31·8 | ... | 0·408 | 0·0137 | 0·0335 |

Resistance of this motor when warm was 1·17 ohms.

This motor gave, as will be seen, very small results, both as regards the power given out and the efficiency. This arises from the fact that this motor, whether regarded from an electric or from a mechanical point of view, is extremely defective in construction. When furnished to us the armature and field-magnets were in parallel circuit, but as, from the construction of the motor, during every revolution there are two places where the armature is entirely short-circuited by the brushes, it follows that this arrangement in parallel circuit is very bad. We therefore joined it up in series for our tests, but even then its bad construction, mechanically and electrically, prevented it doing more than a small amount of work, and doing it very uneconomically.

As to the mechanical defects, the Jablochkoff motor consists of two circular coils, like the coils of a tangent galvanometer, placed at an angle of 90° with one another, while a third circular coil, having a slightly smaller diameter than the two fixed coils, revolves inside them with its axis, making an angle of 45° with the axis of rotation. As the moment of inertia of the revolving coil is very considerable, there is a large couple due to the rotation, tending to diminish the angle between the axis of the coil and the axis of rotation, and this torque is so large that even at speeds of 700 revolutions we found it necessary to strengthen the mechanical connections of this coil with the axis to prevent its being pulled out of position.

Sir William Thomson has lately drawn attention to the importance of placing the axis of dynamo machines on board ship parallel with the axis of the ship about which it rolls, in order to prevent undue strain being put on the bearings of the running dynamo machine when the ship rolls. But the Jablochkoff motor is so made as to put the maximum strain on the shaft when rotating.

The next motor was one with a Gramme ring and Siemens' field-magnet weighing 30·8 lbs. It was of the same general construction as the Gramme motor previously tried, but not quite the same in shape—that is, the proportions of the various parts were not the same. With this larger Gramme motor various loads and various speeds were employed, as in the previous cases, the greatest load that could safely be used being 0·88 lbs., the circumference of the compensating dynamometer employed in experimenting with this motor being 33·3 centimetres, and larger than before. The following is a sample of the results so obtained :—

GRAMME RING / SIEMENS' FIELD-MAGNET } MOTOR, 30·8 LBS.

| Revolutions per minute. | Current in ampères. | Potential difference at Terminals in volts. | Load on dynamometer in lbs. | Horse-power given in. | Horse-power given out. | Efficiency. |
|---|---|---|---|---|---|---|
| 932 | 5·4 | 12·8 | 0·88 | 0·0920 | 0·0272 | ·296 |
| 1,543 | 6·3 | 20·2 | ... | 0·170 | 0·0451 | ·265 |
| 2,527 | 6·7 | 28·4 | ... | 0·255 | 0·0738 | ·289 |
| 3,134 | 7·3 | 34·5 | ... | 0·339 | 0·0916 | ·270 |
| 3,252 | 7·7 | 38·4 | ... | 0·395 | 0·0951 | ·241 |
| 4,117 | 8·7 | 45·6 | ... | 0·528 | 0·120 | ·226 |

Resistance of this motor when warm was 0·973 ohms.

The results given in this paper, combined with some thousands of experiments made on our normal-size motor, have led us, since reading this paper, to the means of effecting an important improvement in the direction of diminishing the magnetic friction in these motors; and, by so doing, we have been enabled to increase the power from 0·25 to 0·30 horse, and the efficiency from 30 to 40 per cent.

The following is a sample of the results obtainable with our 37 lbs. motor, with its field-magnet made of the latest shape, and from which it will be seen that its power and efficiency both far exceed anything we have yet obtained with any other motor of about the same weight.

In the following experiments the current, and not the load, was kept constant, as we were desirous of seeing what the motor would do at various speeds when heating to the same amount.

### SOME RESULTS OBTAINED WITH AYRTON AND PERRY'S NORMAL-SIZE MOTORS, WEIGHNG 37 lbs.

The circumference of the circle formed by the axis of the cord of the dynamometer used in these experiments, and shown in fig. 28, was 3·13 feet. The columns headed W and $W_1$ give the weights in pounds in the two scale pans of fig. 28.

| Revolutions per minute. | Current in ampères. | Potential difference at terminals in volts. | W. | $W_1$. | $W-W_1$. | Horse-power given in. | Horse-power given out. | Efficiency. |
|---|---|---|---|---|---|---|---|---|
| 720 | 25·9 | 12·6 | 2·375 | ·375 | 2·0 | ·441 | ·14 | ·317 |
| 1,570 | 25·3 | 19·0 | 2·062 | ·375 | 1·687 | ·645 | ·241 | ·373 |
| 1,710 | 25·3 | 21·3 | 2·000 | ·375 | 1·625 | ·727 | ·266 | ·365 |
| 2,005 | 25·5 | 25·1 | 2·000 | ·438 | 1·562 | ·860 | ·297 | ·345 |
| | | | Lead of brushes now charged. | | | | | |
| 860 | 21·7 | 12·0 | 1·937 | ·375 | 1·562 | ·350 | ·127 | ·363 |
| 1,570 | 21·7 | 17·5 | 1·687 | ·312 | 1·375 | ·401 | ·204 | ·401 |
| 1,190 | 21·5 | 14·1 | 1·812 | ·375 | 1·437 | ·407 | ·162 | ·397 |
| 1,880 | 21·2 | 19·8 | 1·500 | ·288 | 1·212 | ·563 | ·215 | ·383 |

The resistance of the motor when hot was 0·2 ohms.

The following gives a résumé of the best working results as to power and efficiency that we have obtained with motors weighing from 2 to 500 lbs.

| Name of motor. | Weight of motor in lbs. | Horse-power actually given out. | Revolutions minute. | Efficiency. |
|---|---|---|---|---|
| Griscom ... ... | 2·5 | 0·015 | 2,500 | 0·14 |
| Gramme armature ... Siemens' field-magnet | 8·03 | 0·0625 | 2,853 | 0·199 |
| Jablochkoff ... ... | 20·9 | 0·0137 | 780 | 0·0335 |
| Gramme armature ... Siemens' field-magnet | 30·8 | 0·0738 | 2,527 | 0·2829 |
| | | 0·120 | 4,117 | 0·226 |
| Ayrton and Perry ... | 37· | 0·3 | 2,000 | 0·34 |
| | | 0·2 | 1,570 | 0·40 |
| De Meritens ... ... | 72· | 0·75 | 2,000 | 0·500 |
| Siemens ... ... | 519· | 4·96 | 906 | 0·746 |
| | | 5·60 | 731 | 0·714 |

We have to thank several of our students for valuable assistance rendered us during the course of this investigation, and our thanks are especially due to Mr. Tomlinson for his indefatigable exertions.

**The Vienna City Railways.**—It is reported from Vienna that Messrs. Siemens & Halske have obtained a preliminary concession for the construction of the Vienna city railways on the electric system.

## REVIEWS.

*Practical Electrical Units Popularly Explained.* By JAMES SWINBURNE. London: E. & F. N. Spon, 16, Charing Cross.

This is a most excellent little work (of 60 pages), and is written by one who knows exactly what he is writing about; and moreover it is written by one who knows how to give explanations in the clearest possible manner. We can most heartily recommend the book. The author, when drawing an analogy, is careful to prevent misunderstandings by pointing out how far the analogy can hold good for the purpose of the explanation. His criticisms with reference to the loose manner in which mechanical terms are made use of in many books are very just. Thus he says:—"'Power' is also confused with 'mechanical advantage,' as when 'power' is said to be gained by the interposition of levers on geared wheels. 'Power' is also used in some text-books instead of 'force,' as when 'power' at one point of a lever balances weight at another point."

Mr. Swinburne does not attempt to give scientific derivations of the various units, but merely explains them, and compares them with the mechanical units in common use. If the author could in any future edition of his work add explanations of the scientific derivations he would immensely add to its value; such explanations, would, it is true, be exceedingly difficult to put in plain language, but if done they would be very much appreciated.

*Journal of the Society of Telegraph Engineers and Electricians.* (No. 49, Vol. XII.)

This number of the journal contains Messrs. Ayrton & Perry's valuable paper on "Electro-motors and their Government," and Professor Hughes' classic paper on "The Cause of Evident Magnetism in Iron, Steel, and other Magnetic Metals"; an obituary notice of the late General Sir L. Sabine, K.C.B., is also given. A list of accessions to the library of the society, and the usual collection of abstracts from home and foreign journals, completes the volume.

*The Journal of the Amateur Mechanical Society.* (Vol. IV., No. 25.)

This number of the above journal contains a valuable paper by Dr. James Edmunds, on "Ornamental Lathe Screws, and Suggestions for a Standard Mandrel," together with observations on the same by General Clarke, C.B., Rev. S. B. Burnaby, M.A., and Mr. T. W. Boord, the honorary secretary of the society. The great inconvenience which arises from the use of the mandrel of a lathe having its screw cut to suit the convenience of the maker rather than of the user must have continually been felt, and now that the agitation in favour of standard screw-threads and a standard wire gauge is beginning to take effect, the question (among others of a like nature) of a standard mandrel comes opportunely. The proposals would of course have to be very thoroughly sifted and discussed before being adopted, but Dr Edmunds' paper contains something more than a mere germ, and it deserves careful consideration.

*Honour to whom Honour is Due! Edward Davy and the Electric Telegraph, 1836 to 1839.* By J. J. FAHIE, M.S.T.E.

*Short Memoir of Edward Davy.* By HENRY DAVY, M.D.

London: Office of the *Electrician*, 396, Strand, W.C.

These pamphlets, which are reprints from our contemporary, *The Electrician*, are really very interesting reading, and certainly prove that Edward Davy, had he completed the carrying out of the work at which he had laboured, would have been as well known to the world as were Wheatstone, Morse, and others. Unfortunately Edward Davy, just at the moment when success appeared to be reached, elected to quit his

native country for Australia, leaving his nearly-finished work to be carried through by others who, lacking the complete knowledge which only the inventor himself could possess, did not bring the enterprise to a final completion. Unlike the work of many scientists (that of Reis, for example), that of Davy appears to have been complete in all its details, and only required commercial development to have been at once of practical utility.

*La Telephonie en Suisse.* By T. ROTHEN, Directeur-Adjoint des Télégraphes Suisse. Berne: Imprimerie Rieder & Simmen.

This pamphlet gives a very full description of the telephone system in Switzerland. It shows the arrangement of the wires, insulators, instruments, switches, and gives all details with reference to the working of the system, the subscription prices, &c.—in fact is a complete handbook.

## ELECTRIC LIGHT AND POWER CONDUCTORS.

DIAMETERS, WEIGHTS, NEAREST B.W.G. AND RESISTANCES OF 1,000 FEET OF COPPER CONDUCTOR OF DIFFERENT SECTIONAL AREAS, WITH CURRENT IN AMPERES, AND THE CONSTANT $C^2/746$. CONDUCTITY 95 PER CENT. OF PURE COPPER. TEMPERATURE 60° FAHR.

By E. W. BECKINGSALE.

| Nearest B.W.G. Diameter. | | Diameter. | Sec.-Area. | Weights. | | Resistance. | | Current. | $C^2/746$ |
|---|---|---|---|---|---|---|---|---|---|
| No. | Inches. | Inches. | Sq. in. | lbs. | Tons. | Ohms. | Reciprocals. | Ampères. | |
| | | 1·1284 | 1·00 | 3854·2 | 1·7206 | ·00853 | 117·23 | 1000 | 1340·5 |
| | | 1·0705 | ·90 | 3468·7 | 1·5485 | ·00948 | 105·52 | 900 | 1085·8 |
| | | 1·0093 | ·80 | 3083·3 | 1·3765 | ·01066 | 93·789 | 800 | 857·91 |
| | | ·94407 | ·70 | 2698·0 | 1·2044 | ·01218 | 82·065 | 700 | 656·84 |
| | | ·90972 | ·65 | 2505·2 | 1·1184 | ·01312 | 76·203 | 650 | 566·34 |
| | | ·87404 | ·60 | 2312·5 | 1·0324 | ·01422 | 70·341 | 600 | 482·57 |
| | | ·83682 | ·55 | 2119·8 | ·94633 | ·01551 | 64·479 | 550 | 405·49 |
| | | ·79787 | ·50 | 1927·1 | ·86030 | ·01706 | 58·617 | 500 | 335·12 |
| | | ·77768 | ·475 | 1830·7 | ·81728 | ·01796 | 55·687 | 475 | 302·44 |
| | | ·75694 | ·450 | 1734·4 | ·77427 | ·01896 | 52·756 | 450 | 271·44 |
| | | ·73562 | ·425 | 1638·0 | ·73126 | ·02007 | 49·825 | 425 | 242·13 |
| | | ·71365 | ·400 | 1541·7 | ·68824 | ·02133 | 46·895 | 400 | 214·48 |
| | | ·69099 | ·375 | 1445·3 | ·64522 | ·02275 | 43·963 | 375 | 188·51 |
| | | ·66756 | ·350 | 1349·0 | ·60221 | ·02437 | 41·033 | 350 | 164·21 |
| | | ·64328 | ·325 | 1252·6 | ·55919 | ·02625 | 38·102 | 325 | 141·59 |
| | | ·61803 | ·300 | 1156·2 | ·51618 | ·02843 | 35·171 | 300 | 120·64 |
| | | ·59173 | ·275 | 1059·9 | ·47316 | ·03102 | 32·240 | 275 | 101·37 |
| | | ·56417 | ·250 | 963·54 | ·43015 | ·03412 | 29·308 | 250 | 83·780 |
| | | ·53524 | ·225 | 867·18 | ·38713 | ·03791 | 26·378 | 225 | 67·861 |
| | | ·50463 | ·200 | 770·80 | ·34412 | ·04265 | 23·447 | 200 | 53·619 |
| 0000 | ·454 | ·47204 | ·175 | 674·48 | ·30111 | ·04874 | 20·516 | 175 | 41·053 |
| 000 | ·425 | ·43706 | ·150 | 578·12 | ·25809 | ·05687 | 17·585 | 150 | 30·161 |
| 00 | ·380 | ·39894 | ·125 | 481·77 | ·21508 | ·06824 | 14·654 | 125 | 20·945 |
| 0 | ·340 | ·35682 | ·100 | 385·42 | ·17206 | ·08530 | 11·723 | 100 | 13·405 |
| 0 | ·340 | ·33851 | ·090 | 346·87 | ·15485 | ·09478 | 10·552 | 90 | 10·858 |
| ½ | ·320 | ·31916 | ·080 | 308·33 | ·13765 | ·10662 | 9·3789 | 80 | 8·5791 |
| 1 | ·300 | ·29854 | ·070 | 269·80 | ·12044 | ·12185 | 8·2065 | 70 | 6·5684 |
| 2 | ·284 | ·28768 | ·065 | 250·52 | ·11184 | ·13123 | 7·6203 | 65 | 5·6634 |
| 2½ | ·271 | ·27640 | ·060 | 231·25 | ·10324 | ·14217 | 7·0341 | 60 | 4·8257 |
| 3 | ·259 | ·26462 | ·055 | 211·98 | ·09463 | ·15509 | 6·4479 | 55 | 4·0549 |
| 3½ | ·249 | ·25232 | ·050 | 192·71 | ·08603 | ·17060 | 5·8617 | 50 | 3·3512 |
| 3½ | ·249 | ·24592 | ·0475 | 183·07 | ·08173 | ·17958 | 5·5687 | 45 | 3·0244 |
| 4 | ·238 | ·23937 | ·0450 | 173·44 | ·07743 | ·18955 | 5·2756 | 45 | 2·7144 |
| 4 | ·238 | ·23262 | ·0425 | 163·80 | ·07313 | ·20070 | 4·9825 | 42·5 | 2·4123 |
| 5 | ·220 | ·22567 | ·0400 | 154·17 | ·06882 | ·21325 | 4·6895 | 40 | 2·1448 |
| 5 | ·220 | ·21851 | ·0375 | 144·53 | ·06452 | ·22746 | 4·3963 | 37·5 | 1·8851 |
| 5½ | ·211 | ·21110 | ·0350 | 134·90 | ·06022 | ·24371 | 4·1033 | 35· | 1·6421 |
| 6 | ·203 | ·20342 | ·0325 | 125·26 | ·05592 | ·26246 | 3·8102 | 32·5 | 1·4159 |
| 6½ | ·191 | ·19544 | ·0300 | 115·62 | ·05162 | ·28433 | 3·5171 | 30· | 1·2064 |
| 6½ | ·191 | ·18712 | ·0275 | 105·99 | ·04732 | ·31018 | 3·2240 | 27·5 | 1·0137 |
| 7 | ·180 | ·17841 | ·0250 | 96·354 | ·04302 | ·34120 | 2·9308 | 25· | ·83780 |
| 7½ | ·172 | ·16925 | ·0225 | 86·718 | ·03871 | ·37911 | 2·6378 | 22·5 | ·67861 |
| 8½ | ·156 | ·15958 | ·0200 | 77·080 | ·03441 | ·42649 | 2·3447 | 20· | ·53619 |
| 9 | ·148 | ·14927 | ·0175 | 67·448 | ·03011 | ·48742 | 2·0516 | 17·5 | ·41053 |
| 9½ | ·141 | ·13819 | ·0150 | 57·812 | ·02581 | ·56866 | 1·7585 | 15· | ·30161 |
| 10½ | ·128 | ·12616 | ·0125 | 48·177 | ·02151 | ·68239 | 1·4654 | 12·5 | ·20945 |
| 11½ | ·113 | ·11284 | ·0100 | 38·542 | ·01721 | ·85299 | 1·1723 | 10· | ·13405 |
| 12 | ·109 | ·10705 | ·0090 | 34·687 | ·01549 | ·94776 | 1·0552 | 9 | ·10858 |
| 12½ | ·102 | ·10093 | ·0080 | 30·833 | ·01376 | 1·0662 | ·93789 | 8 | ·08579 |
| 13 | ·095 | ·09441 | ·0070 | 26·980 | ·01204 | 1·2185 | ·82065 | 7 | ·06568 |
| 13½ | ·089 | ·08740 | ·0060 | 23·125 | ·01032 | 1·4217 | ·70341 | 6 | ·04826 |
| 14½ | ·077 | ·07979 | ·0050 | 19·271 | ·00860 | 1·7060 | ·58617 | 5 | ·03351 |
| 14½ | ·077 | ·07569 | ·0045 | 17·344 | ·00774 | 1·8955 | ·52756 | 4·5 | ·02714 |
| 15 | ·072 | ·07137 | ·0040 | 15·417 | ·00688 | 2·1325 | ·46895 | 4 | ·02145 |
| 15½ | ·068 | ·06676 | ·0035 | 13·490 | ·00602 | 2·4371 | ·41033 | 3·5 | ·01642 |
| 16 | ·065 | ·06180 | ·0030 | 11·562 | ·00516 | 2·8433 | ·35171 | 3 | ·01206 |
| 17 | ·056 | ·05642 | ·0025 | 9·6354 | ·00430 | 3·4119 | ·29308 | 2·5 | ·00838 |
| 18 | ·050 | ·05046 | ·0020 | 7·7084 | ·00344 | 4·2649 | ·23447 | 2 | ·00536 |
| 19 | ·042 | ·04371 | ·0015 | 5·7812 | ·00258 | 5·6866 | ·17585 | 1·5 | ·00302 |
| 20 | ·035 | ·03568 | ·0010 | 3·8542 | ·00172 | 8·5299 | ·11723 | 1· | ·00134 |
| 20½ | ·034 | ·03385 | ·0009 | 3·4687 | ·00155 | 9·4776 | ·10552 | ·9 | ·00109 |
| 21 | ·032 | ·03192 | ·0008 | 3·0833 | ·00138 | 10·662 | ·09379 | ·8 | ·00086 |

The Standard of Resistance for the above Tables is ·1516 ohms, which, according to Dr. Matthiessen, is the Resistance at 60° Fahr. of 100 inches of pure annealed copper weighing 100 grains; 555 lbs. is taken to be the weight of one cubic foot of pure copper.

The column of Ampères is on the basis of 1000 Ampères per square inch sectional area of the Conductor; the percentage of energy absorbed by the Conductor varies with E.M.F. and is as follows:—

PERCENTAGE OF ENERGY LOST BY THE CURRENTS IN THE ABOVE TABLE WITH THEIR RESPECTIVE RESISTANCES AT DIFFERENT E.M.Fs. LENGTH OF CONDUCTOR 1000 FEET.

| Volts ... ... ... ... | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage of Energy lost ... ... ... ... | 18·96 | 17·06 | 15·51 | 14·22 | 13·12 | 12·18 | 11·37 | 10·66 | 10·04 | 9·48 | 8·98 | 8·53 | 7·75 | 7·11 | 6·56 | 6·09 | 5·68 | 5·33 | 5·02 | 4·74 | 4·49 | 4·26 |

Short lengths of wire up to ·02 sq. in. sectional area (8½ B.W.G.) will carry, with economy, double the number of ampères given in the table—thus a current of 40 ampères will not lose more than 3·3 per cent. of its energy in a length of 100 feet of 8½ B.W.G. wire, E.M.F. 60 volts. The temperature of the insulated wire which forms the limit to its safe conducting power will be increased by approximately 60° Fahr., according to the thickness and nature of the dielectric. Short lengths of wire from ·02 to ·065 sq. in. sectional area (2 B.W.G.) will carry 50 per cent. additional current with advantage—thus a 100 ampère current, through 100 feet of 2 B.W.G. wire will not lose more than 2·5 per cent. of its energy with an E.M.F. of 60 volts, and with the temperature of the conductor, increased by 60° Fahr. It is presumed that the currents never exceed the strengths alluded to.

The constants under the Formula $\frac{C^2}{746}$ when multiplied by the resistances, give the horse-power lost in 1000 feet of the conductor, and when similarly used in connection with the table of resistances at different temperatures, give the horse-power lost in a conductor when raised to a higher temperature by the current.

## RESISTANCES IN OHMS OF 1,000 FEET OF COPPER CONDUCTOR AT DIFFERENT TEMPERATURES.

CONDUCTIVITY 95 PER CENT. OF PURE COPPER

| SEC. AREA. | TEMPERATURES—FAHR. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40°. | 60°. | 80°. | 100°. | 120°. | 140°. | 160°. | 180°. | 200°. | 240°. | 280°. | 320°. |
| Sq.In. | R. | R. | R. | R. | R. | R. | R. | R. | R. | R. | R. | R. |
| ·90 | ·00908 | ·00948 | ·00988 | ·01027 | ·01067 | ·01107 | ·01147 | ·01187 | ·01226 | ·01306 | ·01386 | ·01465 |
| ·80 | ·01022 | ·01066 | ·01111 | ·01156 | ·01201 | ·01245 | ·01290 | ·01335 | ·01380 | ·01469 | ·01559 | ·01648 |
| ·70 | ·01167 | ·01218 | ·01270 | ·01321 | ·01372 | ·01423 | ·01474 | ·01526 | ·01577 | ·01679 | ·01781 | ·01884 |
| ·65 | ·01257 | ·01312 | ·01367 | ·01422 | ·01478 | ·01533 | ·01588 | ·01643 | ·01698 | ·01808 | ·01919 | ·02029 |
| ·60 | ·01362 | ·01422 | ·01481 | ·01541 | ·01601 | ·01660 | ·01720 | ·01780 | ·01840 | ·01959 | ·02078 | ·02198 |
| ·55 | ·01518 | ·01551 | ·01616 | ·01681 | ·01746 | ·01811 | ·01877 | ·01942 | ·02007 | ·02137 | ·02267 | ·02398 |
| ·50 | ·01634 | ·01706 | ·01778 | ·01849 | ·01921 | ·01993 | ·02064 | ·02136 | ·02207 | ·02351 | ·02494 | ·02637 |
| ·475 | ·01758 | ·01796 | ·01871 | ·01947 | ·02022 | ·02098 | ·02173 | ·02248 | ·02324 | ·02475 | ·02626 | ·02776 |
| ·45 | ·01816 | ·01896 | ·01975 | ·02055 | ·02134 | ·02214 | ·02294 | ·02373 | ·02453 | ·02612 | ·02771 | ·02931 |
| ·425 | ·01923 | ·02007 | ·02091 | ·02176 | ·02260 | ·02344 | ·02428 | ·02513 | ·02597 | ·02766 | ·02934 | ·03103 |
| ·40 | ·02043 | ·02133 | ·02222 | ·02312 | ·02401 | ·02491 | ·02580 | ·02670 | ·02759 | ·02938 | ·03118 | ·03297 |
| ·375 | ·02179 | ·02275 | ·02370 | ·02466 | ·02561 | ·02657 | ·02752 | ·02848 | ·02943 | ·03134 | ·03325 | ·03517 |
| ·35 | ·02335 | ·02437 | ·02539 | ·02642 | ·02744 | ·02846 | ·02949 | ·03051 | ·03154 | ·03358 | ·03563 | ·03768 |
| ·325 | ·02514 | ·02625 | ·02735 | ·02845 | ·02955 | ·03066 | ·03176 | ·03286 | ·03396 | ·03617 | ·03837 | ·04058 |
| ·30 | ·02724 | ·02843 | ·02963 | ·03082 | ·03202 | ·03321 | ·03440 | ·03560 | ·03679 | ·03918 | ·04157 | ·04396 |
| ·275 | ·03037 | ·03102 | ·03232 | ·03362 | ·03493 | ·03623 | ·03753 | ·03883 | ·04014 | ·04274 | ·04535 | ·04795 |
| ·25 | ·03269 | ·03412 | ·03555 | ·03698 | ·03842 | ·03985 | ·04128 | ·04272 | ·04415 | ·04702 | ·04988 | ·05275 |
| ·225 | ·03632 | ·03791 | ·03950 | ·04109 | ·04269 | ·04428 | ·04587 | ·04746 | ·04906 | ·05224 | ·05543 | ·05861 |
| ·20 | ·04086 | ·04265 | ·04444 | ·04623 | ·04802 | ·04981 | ·05161 | ·05340 | ·05519 | ·05877 | ·06235 | ·06594 |
| ·175 | ·04669 | ·04874 | ·05079 | ·05284 | ·05488 | ·05692 | ·05898 | ·06103 | ·06307 | ·06717 | ·07126 | ·07536 |
| ·15 | ·05448 | ·05687 | ·05925 | ·06164 | ·06403 | ·06642 | ·06881 | ·07120 | ·07358 | ·07836 | ·08314 | ·08791 |
| ·125 | ·06537 | ·06824 | ·07110 | ·07397 | ·07684 | ·07970 | ·08257 | ·08543 | ·08830 | ·09403 | ·09976 | ·10550 |
| ·10 | ·08172 | ·08530 | ·08888 | ·09246 | ·09605 | ·09963 | ·10321 | ·10679 | ·11038 | ·11754 | ·12471 | ·13187 |

## THE ELECTRIC BRAKE.

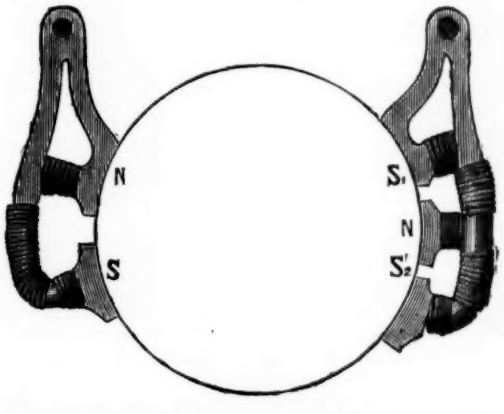
By A. WILKE.

CONSIDERING the importance of the problem to stop an entire train in a moment and from one point, the following proposal for an electric brake will appear justifiable. The suggestion is natural to use for this purpose the electric transfer of power, and there is no difficulty in its application.

The principle upon which the electric brake depends is the increase of friction by magnetism. For this purpose the block of the brake is converted into a powerful electro-magnet of suitable shape. As soon as the electro-magnet is excited by the current it presses strongly against the iron wheel of the carriage or truck, the magnet and the iron of the wheel attracting each other, and great friction between the wheel and the block is the consequence. The appended figure explains at once what has just been said. One of the brake-blocks is given as a bipolar and the other as a tripolar magnet, in order to show that here magnets with many poles may be used.

When the brake is not in use the magnets remain at a distance from the wheel, being drawn back to the distance of some millimetres by a spring.

The magnets are arranged parallel to each other, so that they are mutually independent, and an injury to one does not render the whole apparatus unserviceable. Each carriage is fitted with fixed conductors, leading to the brakes, and connected at each end with suitable




coupling arrangements. For joining the carriages together flexible conductors are employed.

A dynamo machine serves to magnetise the brake-magnets. It is fixed on the locomotive and is driven by a special steam-engine. If the process of accumulation is further developed, accumulators may be used

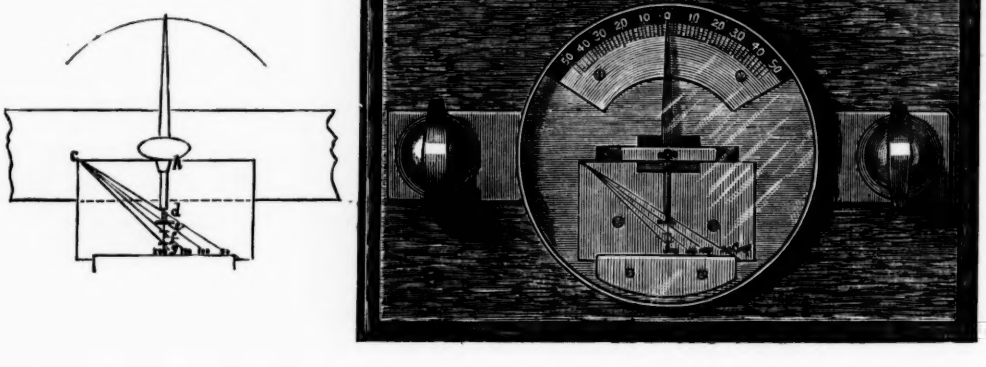
which would possess decided advantages, as compared with direct driving by a dynamo machine. The matter would be still simpler in case of an electric railway. The same current which propels the carriages could be easily passed into the coils of the electro-magnet, and thus produce the desired brake-action in the simplest manner.—*Intern. Zeitschrift Elect. Austellung Wien.*

## PATERSON'S "ENGINE ROOM" AMMETER.

THIS galvanometer is designed as a cheap and effective current indicator for electric light installations for currents of five to 500 ampères.

Instead of a coil of wire, a plain strip of $1 \times \frac{1}{8}$ copper is used. The needle is short and oval, and it is found that the deflection of the pointer is exactly proportional to the current excepting for the first degree or two above zero.

The pointer is counterbalanced by an arm capable of being lengthened or shortened. If the arm is shortened to its full extent, so that the pointer is very nearly balanced, a position may be found for the index so that a current of 50 ampères will just mark 50 degrees on the scale. At its full extent it may take 200 ampères or more to throw the pointer over to 50 degrees. And similarly, positions may be found where




100 or 150 ampères will deflect the pointer to 50 degrees. It is therefore only necessary to multiply the reading by 2, 3, or 4 in these respective cases. The limit of increase of the constant is the carrying capacity of the copper band.

The instrument is thus easily adjustable to serve for small or large currents. To show the amount to which the counterpoise has to be lengthened or shortened, a transparent vernier is provided, ruled on the lines going from a point, *c*, through the various points, *d*, *e*, *f*, *g*, where the index has to be to give the above readings. The intersections of these lines with the perpendicular, *h*, *g*, forms points on which the knife-edge of the index must rest.

If, however, the needle should lose its power in time (as all permanent magnets do), and it is desired to recalibrate the instrument, all that is necessary is to pass a known current of (say) 45 ampères through it and to shift the index of the counterpoise till the pointer rests at 45. The horn vernier or scale will then have to be shifted slightly to the right or the left till the point of intersection, of *c*, *d*, and the perpendiculars, *h*, *g*, is exactly under the new position of the index. The instrument is now in a position to take correct readings of small or large currents, as the new points of intersection on the vernier bear the same relation to one another in position as before.

What is claimed for the instrument is—

1. Universality, in that it is serviceable for small or large currents.
2. Facility for taking readings, they being the same as the degrees on the scale or a multiple of them.
3. Easy calibration.
4. Simplicity of construction, which means a reasonable selling price.

The instrument is now being manufactured by Messrs. Paterson and Cooper.

Our readers will remember a very similar instrument devised by Mr. Henry F. Joel, C.E., and described in the ELECTRICAL REVIEW for May 5th, 1883. We may mention, however, in reference to this, that Mr. Paterson's apparatus was in course of manufacture and experiment some months previous to the article descriptive of Mr. Joel's ammeter, which, indeed, was not so elaborately worked out as regards the adjustment for different strengths of current.

## THE CASE OF GRAMME v. ARNOUX, &c.

JUDGE BLATCHFORD, in the Circuit Court for the Southern District of New York, U.S., has delivered judgment in the case of the Gramme Electrical Company *v.* the Arnoux and Hochhausen Electrical Company.

We owe our readers no apology for calling their attention to this interesting case. It was a suit in Equity for the infringement of the American patent for the Gramme dynamo, No. 120,057, dated October 17th, 1871, for seventeen years from that day.

A very cursory glance at the Arnoux machine is enough to show that it is almost identical with that of Gramme. In fact, almost the only points of difference are that in the Arnoux machine the iron core is composed of a bundle of flat rings instead of a coil of wire, and that spaces are left at intervals between the coils of wire which compose the armature.

The defences set up were a want of novelty, and that the Gramme patent in America had expired. If the former of these defences had been argued it would have raised the very interesting question as to how far Pacinotti's machine had anticipated the machine of Gramme, and also how far Pacinotti had published his invention sufficiently to invalidate an American patent. But the decision of the Court for the defendants went entirely upon the second ground.

To enable our readers to understand the judgment, it is necessary to explain that according to American law (U.S. Statutes, 1870, Cap. 198, sec. 25), any United States patent taken out for an invention which has been already patented in a foreign country shall expire at the same date with the expiration of the foreign patent. The Gramme machine was patented in France in May, 1870, and in Austria on December 30th, 1870. The patent in America was applied for before the Austrian

patent, but was not granted till October 17th, 1871.

As our readers are no doubt aware, the Austrian patent law differs considerably from that of America. The Austrian Gramme patent was granted at first for one year from December 30th, 1870. It was renewed nine times, thus carrying it up to December 30th, 1880, when it was allowed to lapse.

The contention of the plaintiff company was, that the time to be looked to as terminating the American patent was not the actual date of expiration of the Austrian patent, but the time when it would have expired had it been renewed as long as the law permitted. But this view was negatived by the Court, which held (certainly with seeming reason) that the critical date is that of the actual expiration of the patent, which took place on December 30th, 1880, and hence caused the American patent to end at the same time.

It is almost to be regretted that the question of the priority of Pacinotti did not come to be argued, for much interesting evidence had been collected with regard to the nature of these two inventions.

The Gramme patent in England is now so near its term that this curious point will probably never be raised in a court of law, and will therefore only remain as an interesting feature in the history of electrical science. For probably no two inventions have ever been perfected independently, which exhibit such a remarkable similarity, both in principle, in design, and in detail as those of Pacinotti and Gramme.

## THE VIENNA ELECTRICAL EXHIBITION.

(*Continued from p.* 202.)

### PAUL DE LA COURS PHONIC WHEEL SYNCHRONIZER.

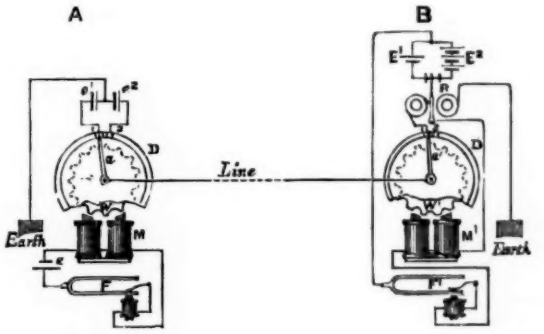
THIS ingenious piece of mechanism is an adaptation of the "Phonic Wheel" of which we gave a description in the number of the REVIEW for Dec. 1st, 1878. Its object is to produce the synchronous rotation of two wheels at two ends of a telegraph line for the purpose of a distributor, as in the Baudot telegraph, or for any other similar object. The phonic wheel, pure and simple, consists of an iron disc with teeth on its periphery, in close proximity to which are the poles of an electro magnet. The distance of the poles apart is such that when one tooth of the wheel is opposite one pole another tooth is exactly opposite the other pole. In circuit with the electro-magnet is a battery and an automatic electro-magnetic tuning-fork make and break. Now, as explained in the number of the REVIEW before referred to, the action of the arrangement is such that, when the tuning-fork is set in action, then if the wheel be set in rotation by a momentary impulse this rotation will be continued by the action of the magnetic impulses which the make and break cause in the electro-magnet, the angular velocity finally becoming uniform and directly proportional to the number of makes and breaks which the tuning-fork makes in a given time. The way in which this principle is utilized for the purpose of producing synchronism of rotation of two wheels is shown diagramatically by the figure.

At station, A, the phonic disc, W, is kept in continuous rotation by means of the tuning-fork make-and-break, F, and the battery, $e$. On the axle of the disc, W, is fixed a radial arm, $a$, at the extremity of which is a small metallic brush which rubs, in the course of its revolution, on two metallic contacts, 1 and 2; these contacts are let into, and are flush with, the surface of the ring, D, as in the Baudot distributor. Contact 1 is connected with the zinc of battery, $e_1$, and contact 2 is similarly connected with the copper of battery, $e_2$; the opposite poles of the two batteries are connected together, and are in connection with earth, as shown. The arm, $a$, is connected to the line wire.

At station, B, the arm, $a_1$, is connected to the line wire, and the contact 1 is connected through the coils of a polarized relay, R, to earth. The tongue of the relay, it will be seen, is connected through the driving electro-magnet, $M_1$, of the phonic disc, $W_1$, to the tuning-fork make-and-break, $F_1$, and thence to the split of the batteries $E_1$ and $E_2$. According, therefore, as the tongue of the relay, R, is over to the right or to the left, so will the strong battery, $E_2$, or the weak battery, $E_1$, be in circuit with, and actuate the make-and-break, $F_1$.

The rate of vibration of the tuning-fork, $F_1$, when actuated by the weak battery, $E_1$, is slightly less than the rate of vibration of the fork, F, but when the strong battery, $E_2$, is in circuit the rate of vibration of $F_1$ becomes slightly greater than that of F. The action of the apparatus is as follows:—

Supposing the tuning forks, F and $F_1$, to be in vibration, and the discs, W and $W_1$, to be rotating in accordance with them, then inasmuch as the fork, $F_1$, is being vibrated by battery, $E_1$, its rate of vibration will be slower than that of fork, F, consequently disc, $W_1$, will rotate slower than disc, W. The result of this is, that in the course of a few revolutions, the arm, $a$, instead




of corresponding in position with arm, $a_1$, will be in advance of it, that is to say, when arm, $a_1$, is on contact, 1 at station, B, arm, $a$, will be on contact, 2, at station, A. Under these conditions the momentary current, which formerly passed to line from battery, $e_1$, now passes to line from battery, $e_2$, and therefore the tongue of relay, R, becomes moved over to the right hand stop, and battery, $E_2$, actuates the fork, $F_1$. This causes the rate of vibration of the latter to be increased, and disc, $W_1$, to turn faster. Disc, $W_1$, now turns slower than disc, W, consequently, after a few revolutions, arm, $a$, lags behind arm, $a_1$, and finally, $a$, makes contact again at, 1 (station, A), when $a_1$, makes contact at, 1 (station B); this causes the tongue of relay, R, to be moved back against the left hand contact stop and battery $E_1$, to be brought again into circuit, which causes arm, $a$, to get in advance of arm, $a_1$, and so on.

The action of the apparatus is so perfect that it is quite immaterial at what points the arms commence to rotate, for one soon gains upon the other until they pass the contacts at stations, A and B, together, when the synchronizing action comes into action, and then the two arms continue practically to rotate in unison.

As the synchronizing contacts only occupy a very small portion of the traverse of the arms, the remainder of the circumference of the circles, D, D, on which the brushes rub, can be occupied with the distribution contacts, as in the case of the Baudot instrument, or for any similar purpose.

*(To be continued.)*

**Fatal Fall of a United Telephone Company's Workman.**—On Saturday morning a young man named Daley, in the employ of the United Telephone Company, was fixing a wire on the roof of some houses in St. Swithin's Lane, when apparently through a portion of the slating giving way, he fell to the ground in a narrow passage which runs from St. Swithin's Lane to Sherborne Lane, by the side of the Bay Tree Tavern. The police immediately went to the spot, but no help was of any avail, the man being quite dead. At the inquest the jury expressed an opinion that the company was to blame in the matter.

# THE PATENTS ACT, 1883.

## TABULAR SUMMARY.

| Who may be a Patentee. | Documents required. | Subject Matter of Patent. | PROCEDURE. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Application by Two Alternative Methods. | Examination. | Acceptance of Documents and Opposition. | Completion of Patent. | | | |
| | | | | | | Filing of Final Specification. | Examination. | Acceptance of Final Specification and Opposition. | Sealing of Patent. |
| An inventor, or inventors, alone, or conjointly with one or more other persons.<br>No patents can therefore be obtained for communicated inventions, as the inventor himself must make the declaration, and if resident abroad he must declare it before a British Consul, or some other competent functionary.<br>Patents will, however, be granted to representatives of deceased inventors if application be made within six months of decease. | For application, a declaration by inventor, or inventors, accompanied by a provisional or complete specification.<br>For completion of patent, if a provisional specification has been deposited at the outset, a complete or final specification will be subsequently required, but if a complete specification has been deposited at the time of the application no further specification is necesrary.<br>NOTE.—*The forms may be purchased at post offices, and as the business of the Patent Office may be conducted by post, inventors can take out their own patents if they simply get a competent patent agent to settle their draft specifications for them.* | This remains the same as at present, but it is expressly stated in the Act that each patent will be limited to *one* invention only, although it may contain more than one claim. | 1.—By leaving at the Patent Office, or sending by post, a declaration and *provisional* specification. | To ascertain whether papers are in proper form; if otherwise they may be amended. The Comptroller's decision is subject to an appeal to the law officer.<br>NOTE.—If after an application is made, and before a patent is sealed another application is made, which appears to cover the same invention, notice thereof is to be given to both applicants, and the second applicant may be refused a patent. Decision by Comptroller, subject to appeal to law officer. | When application is accepted, the invention is provisionally protected for 12 months. | If applicant does not leave a *complete* specification with his application he may leave it at any subsequent time, within nine months, from the date of application, otherwise the application will lapse at the end of the 12 months. | The final specification will then be officially examined and compared with the provisional specification, in order to ascertain that the former is in proper form and in conformity with the latter; if otherwise the final complete specification may be amended. The Comptroller's decision is subject to an appeal to the Law Officer. | When final specification is accepted, it, with the provisional specification, will be thrown open to inspection, this fact being duly advertised.<br>Opposition may then be entered within two months on the following grounds, viz.:—<br>(*a*) Fraud.<br>(*b*) Anticipation by prior application.<br>(*c*) Report of examiner as to confliction with previous applications.<br>Decision by Comptroller subject to appeal to Law Officer, who may call in the aid of an expert. | If no opposition, or if opposition is unsuccessful, the patent will then be sealed, it being dated and sealed as of the day of the application.<br>The sealing of a patent on the second of two concurrent applications for the same invention will not prevent the sealing of a patent on the earlier of such applications.<br>NOTE.—A patent will not be sealed after the expiration of 15 months from date of application.<br>*Exceptions:*<br>(*a*) In the case of the sealing being delayed by an appeal or opposition.<br>(*b*) In the event of death of applicant, in which case the patent will be granted to the legal representative, and sealed within 12 months of such death. |
| | | | 2.—By leaving at the Patent Office, or sending by post, a declaration and complete specification. | Ditto.<br><br>Ditto. | When application is accepted, the invention becomes provisionally protected, and the complete specification is thrown open to inspection, this fact being duly advertised.<br>Opposition may then be entered within two months on the following grounds, viz.:—<br>(*a*) Fraud.<br>(*b*) Anticipation by prior application.<br>(*c*) Report of examiner as to confliction with previous applications.<br>Decision by Comptroller, subject to appeal to Law Officer, who may call in the aid of an expert. | No further specification to be filed. | | | |

* Kindly furnished to the ELECTRICAL REVIEW by T. J. Handford, Esq.

## THE PATENTS ACT, 1883.

TABULAR SUMMARY—*Continued.*

| Extent of Patent. | Duration. | Fees Payable. | | Amendment of Specification. | | Miscellaneous Provisions. |
|---|---|---|---|---|---|---|
| | | First Cost. | Maintenance. | Application for Leave. | Advertisement and Opposition. | |
| United Kingdom and Isle of Man. | 14 years. Privy Council has power to grant extension as at present. | £1 Stamp on declaration. £3 stamp on complete or final specification = £4 in all. | Before end of 4th year - £50 and Before end of 8th year - £100 *or* Before end of 4th year - £10, 5th „ - £10, 6th „ - £10, 7th „ - £10, 8th „ - £15, 9th „ - £15, 10th „ - £20, 11th „ - £20, 12th „ - £20, 13th „ - £20. Total £150 whichever of the two alternative methods of payment is adopted. The Comptroller has power to grant an extension of time not exceeding 3 months for making payment when by accident, mistake, or inadvertence, any prescribed payment has not been made within the prescribed time, a fine not exceeding £10 being payable. The patentee may, however, not be able to obtain damages in respect of an infringement committed in the interim. | Leave may be applied for to amend specification, including drawings, by way of disclaimer, correction, or explanation, but no amendment will be allowed that would make the specification as amended claim a substantially larger or different invention. During legal proceedings liberty to apply for leave to amend can only be granted by the Court or a Judge, and this only for the purposes of a disclaimer. In all cases there will be an immunity for infringements committed prior to amendment, unless patentee proves his original claim was framed in good faith and with reasonable skill and knowledge. *This shews that the fact of the patent office having passed a claim will not be conclusive evidence of its having been properly drawn.* The Comptroller has power to correct clerical errors. | The request and nature of proposed amendment are to be advertised, and one month will be allowed for opposition. Decision by Comptroller subject to appeal to law officer. NOTE.—It would appear that any amendment when allowed (except in the case of fraud) will not be liable to have its legality subsequently called into question. | Compulsory licenses: *section* 22 of Act. Revocation of patents: *sect.* 26. Relation of the Crown to patentee as to user of invention: *sect.* 27. With reference to the institution of legal proceedings or threatening the same: *sects.* 13, 15, 28, 29, 30, 31, 32. As to applications or proceedings in fraud of true and first inventor: *sect.* 35. Exhibits at industrial or international exhibitions: *sect.* 39. As to the extent to which new Act affects existing patents: *sect.* 45 and *2nd schedule.* International and Colonial arrangements: *sects.* 103 and 104. Penalties for falsely representing articles to be patented, and unauthorised use of Royal arms: *sects.* 105 and 106. |

## OBITUARY.

LAST week it was our sorrowful duty to have to record the decease of that eminent electrician Mr. C. F. Varley, and it is now with extreme regret we announce that on Saturday last another well known electrical engineer, Mr. R. Werdermann, was suddenly snatched by the hand of death from the ranks of science at the comparatively early age of 55 years. The deceased gentleman had been resident in London since the year 1870, when he brought over from Paris, and introduced into England, the "Gramme" dynamo-electric machine. Notwithstanding his long connection with the invention of M. Gramme, and the enthusiastic manner in which he championed this most successful machine of modern times, we understand that he sustained heavy losses in his business associations therewith. The recent decision of Judge Blatchford in America declaring the Gramme patent void was, we believe, a most serious and heavy blow to him, as we are informed that he owned the American patent. In 1878 Mr. Werdermann's name was most prominently brought forward in connection with his so-called *semi*-incandescent electric light. We published at the time full particulars of his lamp, which doubtless gave a great impetus to electric lighting in England, and which has since been successfully imitated by other electricians

The subjects we have mentioned are those by which Mr. Werdermann is best known, but the records of the Patent Office show very forcibly his great energy in other directions. For the past two or three years he had busied himself in perfecting a new dynamo and an incandescent lamp, referred to at various times in our columns. He was an eminently practical electrician, and his knowledge of many other branches of science was very considerable. It was our lot to be in almost daily communication with Mr. Werdermann for some years, and to assist in the numberless experiments which he made with dynamos of various constructions, arc lamps and electric candles, electro plating, the transmission of power by electricity, which is now attracting so much attention at home and abroad, electrical railways, and many other minor matters in which electricity played the leading part.

The results of these experiments will probably never be known to the world, but from our own experience we can truly say that many things which are now in successful operation were fully worked out by Mr. Werdermann in the early days of dynamos. His inventive mind led him to attempt too many things, the result being that before one subject had been fairly started towards a successful career it was abandoned for another. Like many others who have laboured towards the advancement of science, it is to be feared that he has left his family, consisting of the widow, a son, and three daughters, without any provision for the future. Space will not permit us to dwell upon the many admirable personal qualities possessed by Mr. Werdermann. An affectionate father, and a staunch friend to those who possessed his confidence, he will be kindly remembered by those who gained his esteem.

We look back with satisfaction that in former days we were enabled to render him such assistance as laid in our power, but it is much to be regretted that his long and laborious toiling has been so ill-rewarded.

## ELECTRICAL RAILWAYS.

AN improved method of operating an electrical railway by which the quantity of electricity for working the same can be regulated automatically has recently been invented and patented by Mr. Leo Daft, of New Jersey, America.

The improvement in the system of operating electrical railways consists in an arrangement of mechanism whereby two engines may be operated simultaneously by electricity drawn from the same conductors.

The principle of the system is shown by figs. 1, 2, 3 and 4, of which fig. 1 represents a general view of the system; fig. 2 a detailed view of the regulator; fig. 3 a view at right angles to that shown in fig. 2 of the regulator switch or cylinder; fig. 4 is a diagram illustrating two locomotive engines upon one section of track, electrically connected with a fixed dynamo; B represents the fixed dynamo properly connected to the rails, C, C. Upon these rails a varying number of engines are to be operated.

In fig. 4 two locomotive railway engines are shown upon the rails, which engines would have in their operation substantially equal internal resistance, but a

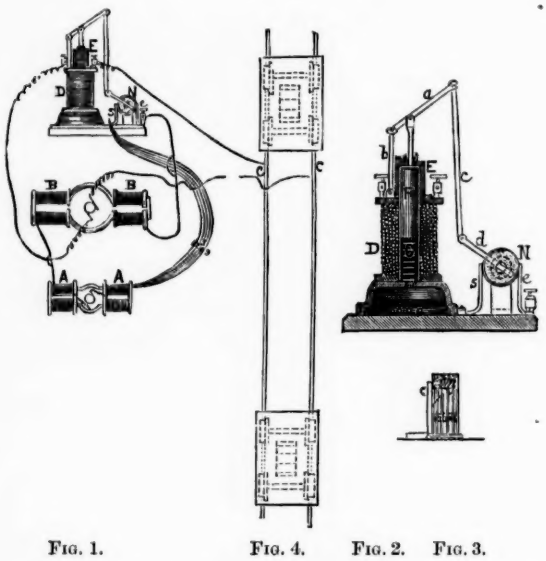


FIG. 1. FIG. 4. FIG. 2. FIG. 3.

greater number of engines may run upon the said rails without interfering with the principle of the apparatus. These engines have substantially the same resistance in their armatures, and the dynamo, B, is arranged so as to supply a sufficient current of electricity to operate all the engines simultaneously. As shown, the dynamo is operated by an independent exciting machine, A, A, although this is not necessary in all cases, as will be explained. It is obvious that the quantity of electricity passing through the field magnets, B, B, will determine the quantity of electricity sent out upon the rails. By varying the quantity passing through the field magnets, B, B, the quantity sent to the rails can be varied. The quantity of electricity passing through the field magnets, B, B, is varied by the regulator shown at D, and in detail by figs. 2 and 3, and by means of the peculiar winding of the exciting machine, A. This machine is provided with a number of independent coils. As shown, five are employed, but this number may be varied. These coils are united at one end, and disconnected at the other, where they connect with five wires, 1, 2, 3, 4 and 5, going to corresponding springs on the regulator cylinder. This regulator cylinder or switch consists of a cylindrical brass plate having an angular edge, as shown in fig. 3, which is adjacent to an insulating surface.

The springs, 1, 2, 3, 4 and 5, are so arranged that, as the cylinder is rotated by the regulator magnet, they will successively ride upon or bear against the insulating surface, thereby throwing the coils connected therewith successively into circuit.

The view shown in fig. 3 represents a view of this cylindrical switch from the side of the regulator magnet, D. As shown, the spring, 1, rests upon the insulating material. As the cylinder is rotated, the springs, 2, 3, 4 and 5, will be in succession brought upon the insulating material, these springs being connected each with an independent coil surrounding the charging magnet. The rotation of this cylindrical switch is accomplished by the axial magnet shown in detail in fig. 2; the coil of this axial magnet, D, is in the circuit leading to the rails. The axial core is shown at F, supported by a spring which may be made adjustable if desired. The axial magnet, F, is contained in the casing, E, which limits its upward movement. The axial magnet, F, is connected with the lever system, *b*, *a*, *c*, *d*, and with the cylinder switch, N.

Now it will be obvious that an increased quantity of electricity flowing through the coil, D, will lower the lever, *a*, and rotate the switch, N, thereby bringing the springs, 2, 3, 4 and 5, in succession upon the insulating surface. The circuits of the exciting machine are plainly shown—namely, through the machine, A, the field magnet cores, B, B, the wire, *f*, to the cylinder switch, thence by the wires, 1, 2, 3, 4 and 5, to its own coils. A suitable spring or springs, *e*, are provided for maintaining a constant connection with the metallic surface of the cylinder switch. The circuits of the dynamo pass from its armature through the coil, D, and the rails.

The operation of the apparatus can now be readily understood.

The apparatus being in the position shown in the figs. is adapted to supply electricity, say, to one engine. If, now, an additional engine should run upon the same section of track, the resistance between the rails would thereby be reduced according to the well known law, thus decreasing the resistance of the circuit passing through the coil, D, and increasing the flow of electricity there-through. By this operation the magnetic field is intensified, and the axial armature, F, drawn down into the coil compressing the spring, G. The amount which the axial magnet, F, is drawn into the coil will be determined by the resistance upon the track, the less the resistance the more will the core be drawn down, and the drawing down of this core will continually increase the quantity of electricity going to the track. The apparatus can be readily applied to a self-exciting machine as well as to one having an independent exciter. In this case the coils of the magnets, B, should be wound separate, as in the case of the magnets, A, and these separate coils should be connected as before to the springs, 1, 2, 3, 4 and 5.

## NOTES.

**Erratum.**—In M. Leon de Locht-Labye's letter, which we published last week, for "*is accurately described* as I have made it, as a rigid inflexible piece," page 209, 4th par. read, is *not* accurately described.

**Electric Lighting.**—Mr. John Burns has ordered from Messrs. J. and G. Thomson, of Glasgow, a large steel twin screw steamer for daily service between Scotland and Ireland. The ship is to be fitted with every modern appliance, including the electric light, which will be also used as mast head and side lights.

On Friday, of last week, the premises of Messrs. Macintosh and Fleming, at 104, Argyle Street, Glasgow, were lighted for the first time by electricity. The apparatus and fittings were supplied and fitted up by the Electric "Sun" Lamp and Power Company. Six lamps are in use—five inside the warehouses and one outside. This is said to be the first exhibition of the Sun lamp in Scotland, and it has attracted much public attention.

The new Inman steamer *City of Chicago* is fitted

throughout with the electric light, pneumatic bells, telegraph, and every requisite for the comfort of passengers; the handling of the vessel and the rapid loading and unloading of cargo.

The First Commissioner of Works has purchased the Edison Electric plant, which has been used in the House of Commons during the 103 nights of the past session. The success attending this experiment has induced Mr. Lefevre to adopt the light on a permanent footing, and a considerable extension of machinery is now being made by the Edison Company. Next session, therefore, not only the libraries and the dining-rooms of the House of Commons, but also the division lobbies, Ministers' rooms, and precincts of the House will be lighted by the Edison light.

An installation of incandescence lamps was successfully completed by Messrs. G. D. Goold & Co., Gothic Works, Northcote Road, Clapham Junction, S.W.; on Friday, of last week, at the country seat of Mr. Peyton Dashwood, Godstone, Surrey. The lamps, which number twenty, are Swan's 16-candle power, and are tastefully arranged in handsome electroliers and brackets in the dining-room, drawing-room boudoir, smoking-rooms and billiard-room, an opal pendant illuminating the porch and staircase. The battery, consisting of twenty-three cells, is the firm's own patent. The electromotive force is 43·5 volts, and the energy represents 360 ampère hours, at a cost of about 8s. to 10s. per week. This firm is now completing an electrical launch which is upon a different principle to any former attempt, and which is intended to excel in speed and cheap maintenance. We believe the power is to be directly derived from their primary battery.

From American sources we learn that in the patent interference case of Weston against Sawyer and Man, of New York, involving priority of invention for improvement in the art of manufacturing carbon conductors for incandescent lamps, the Examiner of Interferences has rendered a decision awarding priority of invention to Weston; and that the Board of Examiners-in-Chief of the Patent Office has rendered a decision, reversing a former decision of the Examiner of Interferences, and awarding priority of invention to Thomas A. Edison for an "incandescent conductor for an electric lamp formed of carbonized paper." William E. Sawyer and Albin Man contested Edison's claim.

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**The Swan United Electric Light Company, Limited.**—An Extraordinary General Meeting of the Swan United Electric Light Company, Limited, will be held at the Terminus Hotel, Cannon Street, London, on Tuesday, the 2nd October, 1883, at 12 o'clock (noon), for the purposes of considering and, if approved, of adopting and confirming the terms of an agreement about to be entered into and to be made between the Edison Electric Light Company, Limited, of the first part, the Swan United Electric Light Company, Limited, of the second part, and a trustee for and on behalf of a company intended to be registered under the name of the Edison and Swan United Electric Light Company, Limited, of the third part, being a conditional agreement for the sale, to the last-mentioned company, of certain of the business, goodwill, patents, rights, privileges, and other property of the Swan United Electric Light Company, Limited, and of empowering the directors to do all such things as may be necessary for carrying such agreement into effect, with such modifications and additions (if any) as they may find necessary. Some time since we suggested that such a step as this appeared to be more than probable, but why the Swan Company cannot work independently and successfully is, to us, a mystery. We should have thought that sufficient warning had already been given to intending monopolists by recent events in the electrical world.

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**The Proposed New Atlantic Cables.**—The following was addressed to the *Pall Mall Gazette* by Mr. H. Weaver on September 6th:—"In the article published under the above heading in your impression of the 4th instant, the following paragraph appears:—

> The new company calculates the volume of cable business on a tariff of one shilling per word at 30,000,000 words per annum. Allowing to the joint companies 20,000,000 words, their revenue would be £1,000,000; their working expenses being, say, £250,000, and their renewal fund £300,000, their net earnings would be only £450,000, or 3½ per cent. on the capital. The new company, with two cables, doing the remaining 10,000,000 words business, would earn £500,000. Allowing working expenses of £56,000, and a renewal fund of the same amount, would leave a net profit of £400,000, or over 25 per cent. on the capital.

As these calculations have been prepared upon a basis entirely hypothetical, I should be obliged if you will furnish your readers with actual statistics, which will give them an opportunity of comparing facts with estimates. The tariff at 1s. per word, which Mr. Alderman Hadley proposes to adopt, was in operation upon the cables of the Associated Companies from the 1st of August, 1881, to the 21st of May, 1882, a period of 10 months, and the total number of words transmitted by all the companies was 11,901,511, or at the rate of about 15,000,000 words per annum, in place of 30,000,000 words, as stated in the proposed new company's estimate. It cannot seriously be contemplated that the new company, with two Atlantic cables, would succeed in obtaining more than its due proportion of the total traffic, so that, assuming the present companies should derive no advantage from their valuable exclusive agreements in America, the Continent of Europe, and the United Kingdom, the most favourable representation of the revenue of Mr. Hadley's company would be as follows:—

| | | |
|---|---|---|
| Total traffic upon 10 cables ... ... ... | | 15,000,000 words. |
| Proportion accruing to the two new cables—*i.e.*, ⅕ | | 3,000,000 words. |
| 3,000,000 words at 1s. per word ... ... ... | | £150,000 |
| Working expenses as per new company's estimate ... ... ... | £56,000 | |
| Renewal fund ditto ... ... ... | 56,000 | |
| | | 112,000 |
| Leaving a balance of ... ... ... ... | | £38,000 |

which shows a profit of 2½ per cent. upon a capital of £1,500,000, instead of 25 per cent. as promised. In the above estimate nothing is allowed either for repairs of cables, or payments to the English Post Office telegraphs and connecting companies on both sides the Atlantic. The annual repairs for two cables, including the maintenance of a repairing ship, would amount to at least £10,000, and the paids-out above mentioned to about £25,000, after deducting which the profits would practically vanish. The estimates of traffic made by proposed new Atlantic companies are always greatly in excess of actual results. The increase in the number of messages, consequent upon the adoption of reduced rates, has been most disappointing; as a matter of fact a decrease in the charge of 50 per cent.—*i.e.*, from 2s. to 1s.—resulted in an increase of traffic of only 27 per cent., showing conclusively that low rates fail to produce an equivalent augmentation of revenue, and are consequently for the present impracticable.

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**Spanish National Cables.**—The ss. *International* and ss. *Dacia* left the Silvertown moorings respectively on Monday and Tuesday, for Greenhithe, and, after having adjusted compasses, sailed from thence for Cadiz on Wednesday afternoon, the 19th inst. After landing the Cadiz shore end, the first work to be done by the ships is to make a very careful survey of the bottom, between Cadiz and the Canary Islands. We referred in our last week's number to the French surveying vessel *Talisman*, and we are now informed that the soundings taken by that ship, prove that there exist between Cadiz and the Canary Islands, several patches of shallow water. In latitude 33° 16′ 20″ N. and longitude 11° 14′ 40″ W. of Paris, they found only 66 fathoms —rock and shell—and from a series of soundings taken in that latitude, it appears that there exists a bank extending some 8 miles in latitude and 31 miles in longitude. On looking over the charts, this bank is in the same latitude as the "Seine bank," found by the

ss. *Seine*, of the Telegraph Construction and Maintenance Company, when laying the duplicate cable last year, between Lisbon and Madeira. In latitude 32° 29′ 20″ N. and longitude 12° 7′ 10″ W. of Paris, the *Talisman* found 455 fathoms—mud; and in latitude 31° 34′ N. and longitude 12° 41′ W. of Paris—497 fathoms—red mud, both these soundings being flanked by depths varying from 1,000 to 1,400 fathoms. The surveying work to be done by the *Dacia* and *International* will, therefore, be very extensive, and the results obtained by the *Talisman*, no doubt, will prove of the greatest importance to the successful laying of the cables.

**West India and Panama Telegraph Company.**—The s.s. *Grappler*, Captain J. Cole, is now lying off Messrs. Siemens Bros. & Co's works at Charlton. She is shipping the 250 miles of cable which have been made there for the West India and Panama Telegraph Company.

**Telegraphing the work of the Scotch Crofters' Commission.**—The Royal Commissioners appointed to inquire into the condition of Scotch crofters in the highlands and islands ended their second series of meetings last month at Oban. This session consisted of 25 meetings, and gave rise, it is believed, to more telegraph work than any "special event" of a similar kind has done before. To overtake the work a "special staff," in charge of Mr. Rose, inspecting telegraphist for the northern district, had been furnished by the Edinburgh office, assisted by local men as occasion required; and we are glad to learn that their services gave the press most unqualified satisfaction. To give an idea of the wide range of country over which they operated, we note that the inquiry included places as far apart as Shetland and Mull, and that the distance actually travelled considerably exceeded 2,000 miles. Wheatstone apparatus was used throughout, and the continuity and fulness of reports reproduced in the daily papers were the subject of general remark. The average number of words per meeting was about 11,000, or a total of about 275,000, or nearly 137½ columns of the *Scotsman*. A portion of the staff, with their apparatus, remain for service at Oban until the end of the season, the pressure of work at that favourite seaside resort having necessitated special appliances this season.

**Telegraphic.**—The directors of the Great Western Railway Company are now advertising for tenders for telegraph wire, instruments and materials.

**The Proposed New Telephone Exchange at Aberdeen.**—The *Aberdeen Free Press* understands that steps have now been actively taken for the establishment of a second telephone company at Aberdeen. The instruments will, we believe, be shown to the interested public on a very early occasion, and efforts will immediately be made to obtain subscribers for an annual payment, it is said, of £5. The name of the company has been mentioned as St. George Telephone Company, Limited. Further information reaches us to the effect that the Aberdeen St. George Telephone Company last week fitted up a number of St. George's telephones in the lecture hall of the Café Buildings, Aberdeen, for public inspection. Mr. Terraneau, the general manager of the St. George Telephone Company, conducted the tests, which are said to have been very satisfactory. The new company has prospects of getting a large number of subscribers among the commercial men of the city. The exact annual rental is not yet known, but it is thought by the promoters that it will be quite practicable to offer it at something like the price formerly mentioned, namely, £5 10s. per annum. The St. George Telephone Company has already obtained licences for London, Liverpool, and Manchester, and these will be followed by similar concessions for Glasgow and Edinburgh. We understand the company would have supported the proposed Aberdeen company had its hands not been so full otherwise, but though unable to take Aberdeen, it has every intention of giving the local company as much support and assistance as possible.

The National Telephone Company has just issued to the Aberdeen subscribers a small book giving the names of their subscribers in that city. From this book it appears that the number of Exchange connections is 249, and the number of private renters 16. The longest line is 5 miles 654 yards, and the total length of wire 150 miles. As regards tariff, it is stated in an introductory note to the book that the rate for exchange connection, which experience has proved to be the lowest possible with efficiency, is for one mile or under £10 per annum. In Scotland the company has intercommunication with Glasgow, Edinburgh, Paisley and Greenock, and it is proposed to add Dumbarton, Coatbridge, and Hamilton, as soon as the necessary arrangements with the post office are completed. Inter-communication with Aberdeen, Dundee, Forfar, Edinburgh, Kirkcaldy, Glasgow, Paisley, and Greenock, is hoped to be established at no distant day. Communication now exists between Bradford, Leeds, Huddersfield, Dewsbury, and Bately, and between Birmingham and Wolverhampton. Plans are being actively prepared with the object of connecting Belfast and Dublin with Newry, Lisburn and Banbridge.

**The Vienna International Electrical Exhibition.**—Mr. W. H. Preece, chief electrician to the British Post Office, delivered a lecture in English on Wednesday of last week, before a large audience at the Vienna Electric Exhibition, on the progress of telegraphy in England.

**Electrical Science.**—Under the presidency of M. Georges Berger, the General Commissioner of the 1878 Exhibition and of the Electrical Exhibition, a society for the improvement of electrical science has been founded in Paris, and the best-known names of *savants* and engineers are associated in it.

**Trades Unions and Technical Education.**—It augurs well for the future of English workmen when they take the initiative in matters relating to the higher education of their own class; and such at any rate appears to be the course adopted by the Trades Unions of Nottingham. On Thursday evening last a meeting was convened by a number of representatives of the several trades unions of the town, calling themselves the Trades' Council of Learning, for the purpose of considering the question of technical education, and the visit to the town of the Trades' Union Congress afforded a good opportunity for the assembly. The chair was taken by Mr. S. Morley, M.P., and among the speakers were Mr. Summers, M.P., Mr. Woodall, M.P., Col. Seeley, M.P., Mr. Broadhurst, M.P., and the Mayor of Nottingham. The Albert Hall, which is capable of accommodating about 3,000 persons, was crowded by an enthusiastic audience of working men, and the resolutions in favour of technical education in the country generally, and in Nottingham in particular, were, of course, carried unanimously. In the course of the addresses some account was given of the technical schools about to be opened in connection with University College, Nottingham. The workshops consist of a carpenter's and joiner's shop, smithy and foundry, machine tool shop, instrument maker's shop, engine shed, dynamo shed, &c. Besides the ordinary vices and hand tools, there will be a cupola capable of running down about half a ton of iron, a brass furnace, a 10-inch self-acting sliding, surfacing, and screw-cutting gap lathe, a 7-inch. Whitworth screw-cutting lathe, a planing machine 6 ft. × 2 ft. 8 in. × 2 ft. 8in., an 8-inch shaping machine, milling machine, shearing and punching machine, drill, &c., &c., in addition to a number of

smaller lathes and other tools made on the premises. The shops and some other portions of the College will be lighted with the electric light, an engine having been provided capable of sustaining between two and three hundred 20-candle lamps. Electrical engineering students will, therefore, be enabled to conduct experiments on a commercial scale, while the lectures upon mathematics, mechanics, electricity, and electrical measurements, given in the Physical Department of the College, will provide the theoretical training required by students intending to become electrical engineers.

Evening classes for artisans will be held in connection with the technical schools at nominal fees. Courses of instruction will be provided for engineers and machinists, and for those engaged in the lace and hosiery manufactures of the town. These classes will be affiliated to the City and Guilds of London Institute for the Advancement of Technical Education. A museum of mechanism, similar to that belonging to the Educational Collection at South Kensington, will gradually be furnished, and it is believed that this will be of extreme value to machinists, as well as to those engaged in the manufacture of lace and hosiery. It is hoped, too, that the classes on Practical Telegraphy, which will be conducted by Mr. Hartnell, of the P.O. telegraphs, will be of great use to those engaged in the telegraphic and telephonic service of the town. Mr. Hartnell obtained the first place in the City and Guilds Examination in Practical Telegraphy in May last.

The school is under the general direction of Professor Garnett, who was a Whitworth Scholar in Mechanical Engineering in 1870, and is known to some of our readers as one of the authors of the memoir of the late Professor Clerk Maxwell, which appeared last year. He left Cambridge in order to accept the Professorship of Mathematics, Physics, and Mechanics in Nottingham about a year ago. In the machine shop Professor Garnett will be assisted by Dr. John Ryan, who is also a former Whitworth Scholar, and is a Scholar of King's College, Cambridge, and D.Sc. of the University of London. A staff of skilled artisans will also take part in the instruction. Our readers will find some particulars respecting fees, &c., in our advertising columns.

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**Electrical Technical Education.**—Hitherto the courses at the City and Guilds of London Technical College, Finsbury, have been only provisional, but the calendar of the first complete course to be given during the next session 1883-84 has reached us. In the evening the students are at liberty to take up any subject or course of subjects they desire, but they are recommended to follow a certain prescribed course depending on their profession. But the day students, on the other hand, are on a somewhat different category, for in their case attendance at all the classes of a prescribed course is, as a general rule, obligatory. We understand, however, that in the case of *bonâ fide* apprentices and others whose professional occupations would render it impossible for them to attend any one complete day course, applications for permission to omit certain parts of such prescribed course will be carefully considered, and such permission, as far as possible, accorded. We also observe that in special cases to be considered by the committee the fees for such students may be reduced or remitted altogether. The privilege to attend certain of the day classes only will be a great boon to lads apprenticed to electrical engineers, seeing that the needs of electric lighting frequently require them to attend to their professional duties during the latter part of the afternoon, especially during the winter, and thus render it impossible for them to devote the whole day to their technical education. And we hope that this offer on the part of the institute will be warmly responded to by early application being made by numbers of electrical apprentices to attend certain portions of the electrical engineering courses which commences on October 4th.

**The Illumination of Lighthouses.**—The Shipmasters' Association held a meeting at South Shields last week to consider the subject of lighthouse lighting for the coasts of Great Britain and Ireland. It was agreed to petition Parliament to appoint a commission to consider the best method.

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**Award.**—Messrs. John White & Sons, Park Road Tannery, Bingley, have received official intimation from the British Commissioner at the Amsterdam Exhibition that the jury has awarded them a bronze medal for their exhibits in belting and other mechanical leathers.

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**The British Association.** — Professor Cayley, the President of the British Association meeting, now being held at Southport, delivered his inaugural address on Wednesday evening. All matters of interest to electrical engineers will be fully reported in the columns of the ELECTRICAL REVIEW.

## NEW COMPANY REGISTERED.

**Electrolysis Company, Limited.**—Capital, £40,000, in £50 shares. Objects:—To carry on the business of electric engineers, electrotypers, and metallurgists, and in particular to obtain patents in any country other than North or South America, for an invention for separating compounds of metals and ores and for precipitating, refining, or depositing the component parts thereof. Signatories (with one fully-paid share each): —R. Guy, 85, Gracechurch Street; L. Elmore, 51, Queen Victoria Street; C. A. Gregory, 5, Duchess Street, Portland Place; C. F. Jones, 5, Duchess Street; A. Zeehandelaar, 76, Petherton Road, N.; A. H. Sumner, J.P., 16, Bury Street, St. James's; J. J. Shedlock, 40, Bishopsgate Street Within. Registered 18th inst., by Mr. R. Guy, of 85, Gracechurch Street.

## OFFICIAL RETURNS OF ELECTRIC COMPANIES.

**Insulite Company, Limited.**—The annual return of this company, made up to the 23rd ult., was filed on the 7th inst. The nominal capital is £20,000, in £10 shares. 1,000 shares have been issued, and are fully-paid, and are divided amongst 40 members. Registered office: 11, Delahay Street, Westminster.

## BILLS OF SALE FILED.

**Pyramid Electric Company, Limited,** Whitecroft, Forest of Dean, to William V. Bonnor. Dated September 5th. Filed September 6th. £250.

**Gulcher Electric Light and Power Company, Limited,** registered office, Battersea Foundry, Battersea, to William Crookes. Dated September 3rd. Filed September 8th. £5,000, &c.

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**Removal.**—The offices of the Telephone Company of Austria, Limited, have been removed to 34, Walbrook, E.C.

## NEW PATENTS—1883.

4365. "Electric meters." P. JOHN, J. PARSONS, M. F. PURCELL. Dated September 12th.

4381. "Electric lamps." J. W. SWAN. Dated September 13th.

4393. "Telephonic apparatus." T. H. MEATCHEM. Dated September 13th.

4416. "Apparatus for use in charging secondary batteries or accumulators." T. J. JONES, E. C. RIMINGTON. Dated September 14th.

4419. "Dynamo-electric machines." W. M. MORDEY. Dated September 15th.

4421. "Electrical signalling and indicating apparatus." G. PORTER. Dated September 17th.

4427. "Improvements in igniting and discharging by electricity cartridges containing gunpowder or other explosive compounds from sporting and military guns, rifles, double or single barrels, or any number of barrels, revolvers, pistols, or any kind of firearm or machine guns, and in cartridges or safety triggers therefor." T. P. WOOD. Dated September 15th.

4453. "Apparatus for measuring electric currents and electromotive force." R. E. B. CROMPTON, G. KAPP. Dated September 18th.

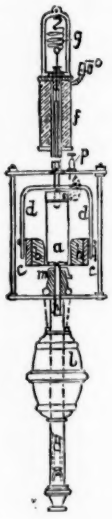
4460. "Improvements in the manufacture or construction of electric cables, and in apparatus or devices connected therewith." A. J. BOULT. (Communicated by T. B. Hyde). Dated September 18th.

4465. "Fittings for electric lighting, applicable also to other purposes." J. H. SHELDRAKE. Dated September 18th.

4467. "Solutions used in galvanic batteries." W. R. LAKE. (Communicated by J. H. Peckham). Dated September 18th.

## ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1882.

6185. "Electric arc lamp." ALEXANDER MELVILLE CLARK. (Communicated from abroad by La Société Solignac et Cie., of Paris, France.) Dated December 27. 6d. This invention relates to an improved electric arc lamp, in which the upper or negative carbon is made to act also as a reflector for the light, and it consists in substituting for the ordinary pencil form electrode a block or stick of carbon of relatively large section, enclosed by and resting in an annular cup or block of refractory material, which, by protecting the sides of the carbon from the oxygen of the air, prevents its lateral combustion, and permits only its lower end to be consumed. This it does evenly over its whole surface, which remains flat and forms a powerful reflector in close proximity to the arc. Moreover, as its rate of consumption is inappreciable, the lamp may be considerably simplified, as the upper carbon descends by its own weight in the annular cup of refractory material in which it rests, a solenoid only being required to raise it from the lower carbon in order to establish the arc. It therefore remains only to provide means for feeding the




lower carbon, which may be done by a counterweight pressing it up against a fixed collar or abutment. In the fig., *a*, is the upper carbon, surrounded by the annular block, *b*, and resting on an internal lip thereof. This block is held in a casing, *c*, hung by a stirrup, *d*, to the core, *e*, of a solenoid, *f*, the core being attached to a spring, *g*, by which the whole of this free or moveable portion of the lamp is suspended and balanced. *h* is the lower carbon, pressed upwards by a counterweight, *l*, against an annular abutment, *m*, surrounding the point of the carbon. The current enters at the terminal, *o*, traverses the solenoid, passes through the flame of the lamp to the lower carbon, returning by the upper carbon and a flexible connection to the insulated terminal, *p*. The arc is established by the solenoid raising the block, *b*, and upper carbon, *a*, immediately the current passes, the length of the arc being varied by the solenoid inversely as the intensity of the current, so that an absolutely fixed light is obtained.

6193. "Incandescing electric lamps." T. J. HANDFORD. (A communication from abroad by T. A. Edison, of America.) Dated Dec. 28. 6d. Relates to incandescing electric lamps, wherein flexible filaments of carbon are enclosed in hermetically sealed chambers made entirely of glass, with leading in wires passing through and sealed into the glass; and the object of the invention is, principally to lengthen the life of electric lamps of this character, by diminishing the electrical carrying between the flexible carbon filament and the enclosing chamber, or the metallic terminals of the filament within the lamp, and incidentally, to increase the resistance of the lamp, so as to reduce the investment required for conductors. In carrying out the invention, the flexible carbon filament is produced by the carbonization under strain or pressure of any suitable organic material, reduced or not reduced to an amorphous or semi-amorphous condition, in the way now well understood.

6196. "Insulating conductors for electric lighting and other purposes." WILLOUGHBY SMITH. Dated December 28. 4d. This invention has for its object improvements in insulating conductors for electric lighting and other purposes. The inventor has discovered that the gutta perchas, which cannot alone be applied to a conductor by means of a die, can be rendered workable by admixture with ground coal, and that so mixed they form compounds very suitable for the insulation of such conductors as are employed in electric lighting, and for other purposes. The gutta percha and the ground coal are thoroughly kneaded together, and the dough-like mixture, is then applied to the conductor in the usual manner.

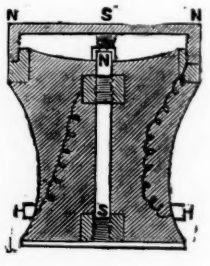
6199. "Distribution of electrical energy for light, power, and other purposes." T. J. HANDFORD. (Communicated to him from abroad by T. A. Edison, of America.) Dated Dec. 28. 6d. Has for its object providing a system in which currents of high tension can be used, while at the same time each translating device (lamp for example) is entirely independent of all the others; and this object is accomplished by employing a source of energy of high electromotive force, arranging the translating devices in multiple series, dividing the said source into as many parts as there are translating devices in series in any circuit extending across between the main conductors and correspondingly dividing each series of translating devices, such division being made by means of a central compensating conductor or conductors connected between the parts or divisions of the source of energy and also between the translating devices, so that when all the devices in any multiple arc circuit are in use current will pass through all such devices, the current passing across from the positive to the negative main conductor, but if one or more translating devices (lamps for example) are removed from any series circuit the excess of current which would otherwise affect the other lamps in the circuit is taken by the compensating central conductor so that the other lamps remain unchanged.

6206. "Incandescing conductors for electric lamps, &c." T. J. HANDFORD. (Communicated from abroad by T. A. Edison, of America.) Dated Dec. 29. 6d. Relates to the production of flexible carbon filaments for the incandescing conductors of electric lamps which shall be of high resistance and of even resistance throughout their length, and have great flexibility, and it consists in forming the incandescing conductor for an electric lamp of a number of fine continuous flexible carbon filaments massed together, so as to be in close contact throughout the whole length and having their ends secured, the separate filaments being capable of independent expansion and contraction.

6218. "Controlling the current in electric circuits by switches, resistances, and similar apparatus." J. JAMIESON. Dated Dec. 29. 4d. The object of this invention is to vary or diminish the strength of current by less expensive and more compact means than are at present generally employed and to prevent or diminish the formation of a dangerous or destructive arc when the current is broken by means of a switch or other arrangement.

6226. "Galvanic batteries." THOMAS JAMES HOWELL. Dated December 30. 4d. This invention relates particularly to the use in a galvanic battery of a porous pot made of pure carbon (charcoal), of manganese and carbon, plumbago and carbon, or of any other suitable carbons found most expedient in the course of manufacture, and placed within an earthenware or any suitable insulating vessel.

6228. "Telephonic and microphonic transmitting instruments." JOHN IMRAY. (A communication from abroad by Dr. Julian Ochorowicz, of Paris, France.) Dated December 30. 6d.




This invention relates to a method of applying, in the construction of telephonic or microphonic transmitting instruments, certain well known magnetic phenomena which are as follows:—When filings of iron or other magnetic metal are placed between

the poles of magnets they arrange themselves in peculiar forms, and any vibratory or other movement of either magnet causes a movement of these particles. By employing such particles, placed in a magnetic field to form part of an electric circuit, the vibration of one of the magnets, resulting from pulses of sound, causes movements of the particles, and these movements produce electrical undulations in the circuit, so that the sound pulses can be reproduced by a suitable receiving instrument at a distance. Transmitting instruments based on this principle, may be made in many different forms. The fig. shows an instrument in which the principle is applied in a form convenient for use. The magnet, N, S, is fixed adjustably in a block of insulating material, such as ebonite and its projecting end, N, is covered by a short piece of tube of the same material or of caoutchouc. The tympan, N, S, N, is in this case a permanently magnetic disc. Obviously, the instrument might be made in many other forms, the magnets being arranged in such a manner as to act on magnetic powder forming part of the electrical circuit.

6235. "Electric arc lights or lamps." W. B. FITCH. Dated Dec. 30. 2d. Relates to improvements in electric arc lights or lamps whereby the intensity of the light is increased in a simple and economical manner. In carrying out the invention the inventor employs a perforated disc, a ring or a bulb of suitable refractory material such as asbestos or the material employed in the manufacture of plumbago crucibles; the said perforated disc, the ring or the bulb is suitably fixed or suspended between the carbons, and when the current passes, the disc, ring or bulb in a short time becomes heated to white heat thereby increasing the intensity of the light and rendering it more uniform. The disc, ring or bulb may be of suitable shape, and in addition to the vertical perforations the disc, ring or bulb is also perforated horizontally for the admission of air to the carbons.

6237. "Electric lamps or lighting apparatus." W. R. LAKE. (Communicated from abroad by R. Mondos, of Paris.) Dated Dec. 30. 6d. Relates to improvements in the electric lamps in former letters patent, dated 15th December, A.D. 1881, No. 5490, fully described in the ELECTRICAL REVIEW for Aug. 19th, 1882.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Letters, &c., for the "Correspondence" columns should arrive not later than Tuesday morning if they are desired to appear in the following number, such communications to be addressed to the "Editors," ELECTRICAL REVIEW, 22, Paternoster Row, London, E.C.

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Cheques and Post-office Orders (on Chief Office, London) to be made payable to H. ALABASTER.

# CORRESPONDENCE.

### Patent Motor (Bunsen) Battery.

In Mr. Toynbee's motor battery (see ELECTRICAL REVIEW, p. 152), 58 cells appear to have been charged by 3 lbs. nitric acid and 3 lbs. sulphuric acid.

This excites hope that by some new form of battery, at present unknown to me, a powerful current could be produced, if even only for a short period, by which motors, coils, &c., could be worked for experiment or otherwise at a very small cost.

I expect some new form of cell is in the market by which very small quantities of acid need be used at a time without diminishing the size of the zinc.

In Mr. Toynbee's battery this is very large, viz., 60 square inches of zinc surface acted upon in each cell, as I learn from a reply Mr. Toynbee very kindly sent me by post to an inquiry I made. At the same time, as Mr. Toynbee says all further particulars are to be found in the ELECTRICAL REVIEW, I should be very interested and obliged if you will kindly point out where I can find a description of this economical battery. I am perplexed by 58 cells, of 60 square inches of zinc in each, requiring but 3 lbs. nitric acid and 3 of sulphuric. Do you consider they were very narrow flat cells or that Mr. Toynbee has charged in estimate of cost of materials, acids partially used, which I can hardly suppose, as he concludes his letter to the ELECTRICAL REVIEW with "pass a current same time, *say* 10 *hours*."

You will, no doubt, enlighten your obedient servant,

**C. Bennett.**

Woodlands Road, Redhill,
*Sept.* 13*th*, 1883.

[See ELECTRICAL REVIEW for June 23rd, 1883.—EDS. ELEC. REV.]

### Engine Power Meter.

I see that in the head line of the article on Boy's Engine Power Meter, you class that instrument as an "electrical" one. Is it quite correct to do this? The meter is certainly very interesting and valuable to an electrical engineer who wants to know how much engine power is being used by his dynamo, and this special application of the instrument is doubtless what the writer had in view, though no reference is made to the matter in your article.

There can be no question at this important juncture, that some reliable statistics as to the actual power consumed by different dynamos when doing similar work, would be very acceptable to many others besides the technical electrician. We hear, now and again, from inspired sources a great deal of twaddle about the "efficiency" of particular dynamo-machines, but is there anywhere to be found a faithful record of, on the one hand, the actual foot pounds of work done by an engine driving a dynamo for a fixed period, and, on the other, of the actual electrical energy in volt ampères produced? Till these data are properly tabulated, it seems to me a farce to talk about the efficiency of any machine. Boy's Engine Power Meter certainly brings us a step nearer this desirable goal. Any way, it enables one to measure in a very simple and direct manner the work done by an engine on a dynamo, and this is a boon which the practical electrician who has had to approximate to the desired result by taking interminable indicator diagrams, will not be slow to appreciate.

**W. J. Ward.**

4, Wells Street, Oxford Street, W.

### Patents for Telephones.

Thanks to your correspondent "Inquirer" for his remarks on the concluding sentence of my letter published in the REVIEW of 8th inst. I confess to have ignorantly sinned, and I must admit that my error gave him good reason for asking "what *good* and weighty reasons I have for the great change in my opinion as to the claims of Bell's patent." My statement seems to have been so clear and emphatic that it would lead anyone to suppose that I had changed my opinion, as it is so diametrically the antithesis of all my previously-expressed opinions. I have in no wise changed my opinion in regard to Bell's claim; but in the sentence for which I am taken to task, I committed the grievous sin of *omission*. That sentence recalls to my mind the announcement by the theatrical manager, of the play of "Hamlet," with the part of Hamlet left out. The omission in that sentence corresponding to the part of Hamlet left out, is the words "held all round its edge" after the word diaphragm. It surely was not a fault of my memory, the sentence was, no doubt, the result of a mechanical movement of the fingers without being guided by the mind. I plead guilty of the omission, and all I can say in extenuation of my offence is, "even Homer nodded."

I must correct the statement of your correspondent that I have sold my patents to the United Telephone Company—such is not the fact. I did not sell them to the United Telephone Company. And I can assure him that I am not "now a faithful defender of the claims of the monopolists to every form of magneto-telephone," and to "every form of transmitter in which carbon or any equivalent substance is employed." I maintain that the claims made by the United Telephone Company as above are impudent and false.

Your correspondent must now be assured that I

have not changed my opinion, and therefore could not have had *good* and *weighty* reasons for having done so. In regard to my patents for telephonic instruments which I have sold, I venture to express my opinion that one of them covers every form of magneto-receiving telephone, in which there is the combination of a spiral wire with a helix and a non-inductive plate; also of a magnet with a spiral wire, non-inductive plate and a helix; the other covers every form of magneto-receiving telephone in which there is the combination of a magnet or electro-magnet having a helix on an end, with a tongue of material which can be acted on by magnetism firmly attached at one end, the tongue extending over the head of the magnet and a plate of non-inductive material. For the benefit of inventors, I refer them to patents No. 4,905 of 1881 and 2,259 of 1882. The question put to me by "Inquirer" about the famous Glasgow receiver is fully answered, and I will say that any modification of it, which does not include a plate of any material capable of inductive action "held down all round its edge," is as yet matter for a good and valid patent, and will not be tributary to any claim by Bell, hitherto supposed to be the inventor of a telephone with an iron plate in front of the pole or poles of a magnet. I say *supposed* to be the inventor, because the Examiner at the United States Patent Office, after nearly two years' investigation, has decided, upon the testimony of numerous witnesses, that M'Donough was the first inventor of the iron plate in front of the pole of the magnet, and that M'Donough had such an instrument in actual operation about one year before Bell's first patent of February, 1876. To your correspondent I cannot reply in the Latin quotation he expects, but I will in another—*semper idem*.

**W. C. Barney.**

*Sept.* 17*th*, 1883.

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To the remarks by your correspondent "Observer," notwithstanding his exceedingly courteous language addressed to me, I condescend to send to the REVIEW a few comments.

In the first place, my obtuse intellect fails to appreciate the reason for "his thanks to you on behalf of the inventive public for your remarks" on my letter. Those remarks in no way conflict with any statement made by me, nor are they in any manner a critical commentary on my letter; they are simply a statement of well-known facts, which were not called in question by me, and are simply a supplement for the benefit of the unlearned.

In the second place, my letter does not in any manner suggest even that I have ignored what he terms a *proposition*, viz., "that a new combination of old parts constitutes good subject matter for a valid patent." I did not say that the several patents of which I wrote were not *valid* patents. It may well be that the alteration in detail, or the new combination in them, constitute real improvements, and that as such the patents are good and valid; but if the new combination contains one or more of the devices which have been previously patented, they would be tributary to the previous patents, and any instruments manufactured under them would be infringements of that patent. I do not desire (to quote the elegant and courteous words of "Observer") "to air my knowledge of patent matters," but I submit that the above statement is good law. I shall ever be pleased to receive advice, even from an unlettered tyro, and to acknowledge my errors, and correct them, when my statements shall have been proved to be erroneous; and I shall esteem it a great favour if any one in courteous language will inform me of what "axioms and rudimentary principles of patent law and practice" my correspondence has exhibited my ignorance. I shall also be well pleased if any one will refer me to "the well-merited rebukes to which my epistolary effusions so frequently expose me."

It is a very simple matter for a correspondent, under the cover of an anonymous communication, to make broad and baseless accusations, and charge a person with faults and ignorance, without specifying the errors alleged, or pointing out the particular statements wherein his ignorance is displayed.

**W. C. Barney.**

*Sept.* 18*th*, 1883.

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### The New Patent Law.

This seems to be a rather difficult nut to crack, and will doubtless be disappointing to not a few. One of your contemporaries (the *English Mechanic*) gave vent last week to the idea "that applications left at the office, between now and December 31st, will pay the diminished fees, and escape the examination and the liability to grant licences." In clause 3 of the Act, it says: "This Act, except where it is otherwise expressed, shall COMMENCE from and immediately after the thirty-first day of December, 1883," and clause 45, par. 1 states "The provisions of this Act relating to *applications for patents and proceedings thereon*, shall have effect in respect only of *applications* made after the COMMENCEMENT of this Act" (31st Dec. 1883). The third paragraph is too parliamentary in its clearness for me to be other than very much "mixed" as to its actual purport.

Another doubful point may be best referred to by the question, When does the PUBLICATION of a patent take place? Is it when the Blue Book is issued, or when the final specification is first open for inspection? If the former, then, taken in connection with section 13, "No proceedings shall be taken in respect of an infringement committed before the publication of the complete specification," what is to prevent a smart man making himself acquainted with your invention on the first day of inspection, and during the interim prior to the issue of the Blue Book, manufacturing and selling ahead of you, the very article you have paid money to protect? True, he might sue (after he has qualified) for such as may remain in possession, and make it unpleasant for those who have purchased, though the maker, to gull the public more securely, might have had the audacity to print or stamp the true number of the actual patent thereon. There are scores of useful articles could be so made within a few months.

Having said so much on the awkward side of the patent law, let me say a word on what is favourable. First, there is the reduction of fees in the early stages, and the yearly payment for later ones, so that if a patent does not pay it can be quietly dropped without great sacrifice.

Threats of Legal proceedings (and damage done by such publications), are provided for, as also the growing scandle of calling an article a "patent," which is not paying patent fee revenue. It had been patented, but the firm making, determined to decline paying the £50 fee, but still adhered to calling it "patent," instead of an ex-patent, which it really is. Said firm advertises it as usual, and trusts to the fact of their having been sole makers to continue so. There are two firms who largely advertise "ex-patents" as "patents" in nearly all the engineering journals. Such parties are to be dealt with as wrong doers.

From a monetary point of view the reduction of fees will be most welcome, and will doubtless lead to the taking out of a larger number of patents, and before four years are over, it will be very evident, whether the article pays or not. The cheap way of being enrolled amongst the hard brain-worked of the country—to wit, the provisional application—will not be of service, as, should applicants not proceed further, their efforts will be left in oblivion, and not be a barrier to future thinkers in the same field.

**Saml. Vyle.**

4, New Broad Street, E.C.
*Sept.* 17*th*, 1883,

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May I offer a few remarks from the point of view of an inventor who has also been led to consider this subject from other standpoints as well as that of the purely selfish interests of inventors. I think I may say with safety, that out of the ideas of all sorts

which pass through my own mind and are more or less completely thought out, there are probably at least ten in every year that might pass muster as deserving the title of inventions. Out of this number, perhaps, on the average one gets patented, one or two more are given away, and the remainder rest in the unprofitable idleness of my notebook. Of those that are patented the majority are not a source of any profit to me. Now, this is not a state of things peculiar to me. The tale of the average inventor would be still more discouraging. As the adviser in patent matters of some large companies, I have had many opportunities of seeing the working of the patent laws both in this country and in my own country, America, and my conclusion is, that the one great point to be aimed at in the framing of patent laws, as is now almost universally admitted, namely, the encouragement of invention, is to be attained by the joint means of simplicity and moderate cost in the necessary proceedings. Of the two, simplicity is by far the more important, and if this be secured, cheapness will naturally follow.

Simplicity should begin with the requirements in the way of official formalities. Good paper, of a size and shape easily obtainable in the market, is quite as good for all practical purposes of official examination, record, and preservation of originals—especially when preservation of originals is by law made a matter of no consequence at all, by enacting that the copies furnished by official printers shall be final in evidence—as large skins of parchment, and is wonderfully more tangible to the unprofessional public as well as less expensive.

Simplicity in the statement of the law itself is comparatively easy to secure, because its importance is well understood and long familiar to law-makers in theory, if not in practice.

Simplicity in the proceedings for obtaining a patent, aside from mere formalities, means a great deal more than the framers of the recent Act have shown a disposition to admit. The lowering of fees and abolition of unnecessary steps in the proceedings, are likely to prove only an alluring bait to the trap laid for the hardy adventurer who thinks to patent his invention and secure a monopoly of it for the modest sum of £4 sterling. How many "lambs" will be caught by it, only the initiated may for some time find out. I think it safe to say their name will be legion; for a more cleverly-devised pitfall for the proverbially unwary inventor could not easily be devised than is provided by the opportunity of public opposition before sealing the patent. To the worldly-wise in such matters, it is equivalent to nailing on the door of the patent office a notice in plain English to the effect that "poor men need not apply, as this office is especially intended to protect the vested interests of monopolies." Such a slap in the face as that in good honest English, would tell the poor inventor that his services in pushing the world along in opposition to the at best well-nigh irresistible forces of vested interests were declined *dis*respectfully and with*out* thanks. This would, at least, be honest, which telling him that you have made a law for his especial protection, while you arrange a fatal ambush for the convenience of his enemies is not. It is in consequence of a similar provision in the German law, that honest patent agents generally advise their clients that it is not advisable to apply for a German patent as it is almost sure to provoke costly opposition and may very likely be refused, to the prejudice of patents in other countries; and such will in future have to be the advice given to foreigners intending to apply for English patents also, if not, indeed, to English inventors as well.

This fire-and-water ordeal of public opposition must not be confounded with the American plan of official expert examination, which is generally recognised by American inventors as their best friend, because it shuts out designing charlatans who seek to quietly patent some old invention, and foist it upon the public, to the discredit of honest inventors. The proposed English plan, on the contrary, distinctly encourages such proceedings, if they are only undertaken by parties sufficiently powerful to frighten away or overcome all opposition. Again, the inventor who is refused an American patent may generally safely conclude that his invention is not so new as he thought, and would not probably be worth anything if he did get his patent, and he wisely refrains from spending any more money on it, and turns his attention to something else. No such confidence can, however, be inspired in the result of a pitched battle with interested opponents. On the other hand, the opportunity for opposition will in the long run be a source of loss rather than gain for those in previous possession of the field; for in order to check the force which a movement would gain by their being said to lack the confidence to oppose it, it will become necessary for them to look out very sharply for the appearance of such movements, and use every effort to nip them in the bud. This will make it necessary for every large concern to have some one especially employed to look after such business continually, and expert services of this kind are expensive.

In the matter of subsequent proceedings for annulment and infringement of patents, some advance appears to have been made, but here simplicity has much yet to require of the law-makers of all countries. It would seem to be an axiom of political economy that laws relating to trade should be so framed that proceedings under them shall in the long run show an economic balance on the side of profit rather than loss, but simple as this principle is, it seems to be generally overlooked in the scramble of opposing interests which generally precedes the enactment of a new law. In the matter of preliminary opposition, I think there can be no doubt, from the considerations I have mentioned, even without considering the loss by discouragement of progress, that the proceedings will cost much more than they save to all parties. In the case of subsequent proceedings, the balance to the bad is, under existing arrangements, much greater. The power conferred on the Court by the new Act, of calling in an assessor, is a step in the right direction, but in the face of the demands which the rapidly-advancing importance of patent rights is making, it is only a feeble feeler in the direction of the great reform which can alone satisfy these demands, and show a substantial balance on the right side of the economic account. This coming reform I believe to be the establishment of an expert Court especially for the trial of such cases, and from the decisions of which there shall be no appeal except on points of law, the appeal on such points being reduced to a simple statement of the legal point at issue for decision by competent authority. I have put the question to many inventors and others interested in such cases, whether they would not prefer a judge to a jury, and an unprejudiced expert to either, and I have yet to find any one who had an honest cause to serve who hesitated a moment in his answer. The attempt to adapt to questions of exact science and of simple priority in time, the cumbrous machinery of common law, only results in actions which cost more than they come to.

The few principles which should underlie all decisions in patent law are so simple and so evident that there need be few appeals from the expert Court, and such as there were would be quickly disposed of. I fear though that we must wait for the slow process of the assessor becoming more and more important, and finally becoming the real judge, subject only to legal instruction from the nominal Court, which will be the natural course of evolution, if nothing is done to expedite matters. Meanwhile we must endure such economic scandals as last year's telephone case, where thousands of pounds were as unjustifiably wasted as if they had been thrown into the gutter, in the gambling game of trying to "make the worse appear the better reason" before a Court, or rather Courts, which, without disrespect, may be pronounced utterly incompetent to decide the case, there having been no single point of a purely legal nature brought seriously in question in either Court. It was a common remark during the

trial, that the court-room seemed more like the meeting place of a scientific society than a court of law, the questions discussed were questions of science not of law, and the counsel and the court were alike utterly out of their element in trying to settle them. In such cases the proceedings of the courts, as at present constituted, are a mere game of chance, and the appeal to a higher court only a fresh dealing of the cards. Enormous sums of money are wasted and nobody is satisfied. The losses from an occasional injustice done by summary proceedings in an expert Court would be as nothing to the waste of the present system, and many cases would never be brought into a court known to be capable of deciding them on their merits, which now are entered upon either as a pure game of chance or in the hope of starving out a poorer opponent. The experience of American inventors with expert preliminary decision of claims, not only amply justifies that system, but leads them, in the absence of a regularly constituted expert Court for the settlement of subsequent disputes, to frequently take the law into their own hands and submit to arbitration as the most satisfactory way of settling their difficulties.

Apologising for making my communication so long, I remain

**J. B. Henck, jun.**

31, Queen Victoria Street,
*Sept.* 14, 1883.

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### Coating Carbon Rods with Asbestos Paint.

With reference to the above I may state that whilst manager of the Jablochkoff works on the Albert Embankment I made a few private experiments, with the results shown below.

I coated one rod of a candle with the paint, as prepared for woodwork, and after the candle had been alight for about half-an-hour the rods had assumed the shape shown in the sketch, the bare one having but a fine point for the arc to play upon (the oxygen of the air having attacked and pitted the sides for some distance down); and the covered rod showing a very favourable shape indeed, whilst the ratio of burning was such that the latter was much the longer of the two.

The paint being coarsely ground, it was impossible to have but a thin covering, consequently shadows were thrown from projecting masses (caused by the heat of

the arc on the paint), and the carbon dust lodging there caused a kind of "short circuiting" occasionally.

I next tried the "Special" paint, used for iron work, but found it possessed no heat-resisting property, its merit being in the absence of blistering under heat.

With coppered carbon rods, and either paint, no good results were obtained, as the copper fusing removed the paint to a considerable distance from the arc.

The results I obtained convince me that with a very finely ground and genuine Asbestos paint (such as I have seen supplied by the Scottish Asbestos Company) the objection of shadows and flickering would be removed, also the tendency of the arc to travel, and the life of carbon rods of the gauge experimented upon would be prolonged to at least half as long again.

I am not aware if others have experimented in this direction, but it is certainly worthy of some attention.

**C. Scott Snell.**

St. Paul's Buildings, Paternoster Row,
*Sept.* 18*th*, 1883.

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### The Late C. F. Varley.

In justice to the memory of my late brother, Cromwell Fleetwood Varley, allow me to correct an error which I am sure is unintentional on your part, in respect to the invention of the artificial line. Of all his numerous inventions nothing was more characteristically his own than that particular contrivance.

It is indeed quite new to me that S. Alfred Varley ever laid any claim to its invention; though it is quite true that he read a paper, and showed experiments with resistance coils and condenser, at the Society of Arts in 1859, but in so doing he was merely traversing the ground travelled over by Cromwell Fleetwood Varley five years previously.

The facts are these. Cromwell Fleetwood Varley patented and used condensers in 1854. Most of these were made of alternate sheets of tinfoil and paper, the latter being saturated with a heated preparation of Venice turpentine.

The condensers with resistance coils were brought into play, and enabled Cromwell Fleetwood Varley to hold his own in the controversy respecting aerial *versus* subterranean telegraph circuits, to which you have ably referred.

There was, therefore, in 1854 a germ—nay, more than a germ, a complete image, a fully-fledged artificial line, with a healthy and vigorous constitution, doing good suit and service in the cause of electrical science, the creation of which, like Minerva, proceeded from a fertile brain. The paternity of this creation (*i.e.*, the artificial line), by direct lineal descent from the germ, was justly claimed by Cromwell Fleetwood Varley.

**Frederick H. Varley.**

*Sept.* 18*th*, 1883.

[We publish this letter of Mr. F. H. Varley, but we must remark that a little inquiry on his part would have saved the necessity of its having been written.

We have before us the paper read by Mr. S. Alfred Varley before the Society of Arts, March 30th, 1859, in which the construction of an artificial line is minutely described, and also the discussion which took place upon it. In this, Mr. C. F. Varley, Professor Tyndall, Sir W. Fothergill Cooke, Mr. C. W. Walker, and the then Dr. Charles Siemens took part. No suggestion was made as to any previous claim for the invention of "artificial lines."

We have also recently consulted the patents of the late Mr. Varley, and we find that the first mention of the artificial line occurs in a specification dated Dec. 26th, 1862, nearly four years after the Society of Arts meeting. In this patent he says:—"Part of my invention consists in the employment of a test circuit formed of induction plates and resistance coils, so adjusted to each other as to produce an artificial line possessing the same amount of retardation as the cable itself." In the final specification of this patent *no claims* whatever are made. In two previous patents, however, bearing dates Dec. 5th, 1854, and Jan. 7th, 1860, we find there is mention of induction plates made of sheets of tinfoil separated by gutta-percha, or oiled silk, and also, the use of fluid induction plates, to be used in connection with a galvanic battery, for giving an instantaneous discharge on closing the circuit; but he says, in the complete specification of the latter patent, that he was aware that Jacobi had used for *many years* similar induction plates for an analogous object on lines in which single currents are employed. He therefore only claims their use in connection with his double current system. These early patents do not, however, allude to artificial lines, although they are the first in which there is any mention of induction plates. We shall probably publish an extract from Mr. S. Alfred Varley's paper in our next.—EDS. ELEC. REV.]